B-ICON Proceeding

Proceeding Paper

POTENTIAL OF SURUHAN PLANT (*Peperomia pellucida* L. Kunth) AS ANTIOXIDANT AND SUNSCREEN

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Abstract

Sunlight not only has a positive impact, but also has a negative impact on the skin if exposed excessively. The herbaceous plant suruhan (Peperomia pellucida L. Kunth) contains phenolic compounds, especially flavonoids, which have antioxidant activity and have potential as a sunscreen due to the presence of chromophore groups that can absorb UV rays. This study aims to see the antioxidant activity of suruhan herb plant in the sample used and see its potential as a sunscreen by measuring the SPF value and seeing the physical stability of the extract formulated into a cream preparation. The herbaceous plant was extracted with 96% ethanol solvent. The thick extract obtained was tested for antioxidant activity using the DPPH method, the results obtained an IC50 of 66.82 ppm with a strong antioxidant activity category, then determined the SPF value of the preparation in-vitro using a UV-Vis spectrophotometer at a wavelength of 290-320 nm, the results obtained an SPF value of the extract which increased with increasing extract concentration. The highest SPF value was measured at a concentration of 0.5 mg/ml with an SPF value of 9.9930. Furthermore, the extract was made into cream preparations with concentrations of 0%, 1.4% and 2.8%. The results of the evaluation of the preparation obtained a cream with a semisolid consistency and met all test requirements. From the research that has been done, it is concluded that the herbaceous plant suruhan has potential as a sunscreen cream which also has strong antioxidant activity so that it can prevent skin damage due to excessive sun exposure.

Keywords: Antioxidant, SPF, Suruhan Plant, Peperomia pellucida

Presented at the 4th Bengkulu International Conference on Health (B-ICON), Bengkulu-Indonesia, September 24-26th, 2024

Published: December 31st, 2024

ISSN: 2986-027X

INTRODUCTION

As a natural source of light, sunlight plays a very important role in the lives of all living things. Sunlight not only has a positive impact, but also a negative impact on the skin (Reichrath, 2006). Indonesia is one of the tropical countries with high sun exposure and Indonesia is located in the equatorial region. Global warming causes Indonesia's climate conditions to get hotter so that UV exposure increases. Excessive sun exposure has a negative impact on the body, especially on the skin, caused by ultraviolet radiation (van der Rhee et al., 2016).

Skin is the outermost organ of the body that receives direct exposure to sunlight. The skin has an epidermal layer which is the outermost layer that provides defense from the external environment such as UV exposure, physical damage, chemicals and pathogens. The skin also has a dermis layer which is where hair follicles, nerves, oil glands, and sweat glands are attached (D'Orazio et al., 2013). The adverse effects of sunlight on the skin come from UV radiation. Ultraviolet (UV) rays produced by the sun have wavelengths ranging from 200-400 nm. Based on the wavelength of the UV spectrum is divided into 3 namely, UV C (200-290 nm), UV B (290-320 nm) and UV A (320-400nm). UV C exposure does not reach the earth because it is absorbed by the earth's ozone layer but UV A and UV B are able to penetrate the ozone layer. UV A light exposure can penetrate the dermis layer, while UV B only reaches the epidermis layer. The negative impacts caused by UV exposure are burns due to solar radiation, skin pigmentation, premature aging, and even cancer (Gromkowska-Kępka et al., 2021).

The skin needs protection even though the body has a natural defense system. There are two ways to protect the skin from the dangers of UV rays, namely by physical protection, including wearing umbrellas, wearing hats, wearing long sleeves, long pants, and others. In addition, protection using chemicals can be done by applying sun protection products directly to the skin, such as the use of sunscreen on the skin (Tsai & Chien, 2022).

Sunscreen is a substance or material that can protect the skin from UV rays. The ability of sunscreen to protect the skin and prevent sunlight is expressed through the Sun Protection Factor (SPF) value listed on cosmetic preparations with a certain SPF level label. SPF values range from 2 to 60, a number that indicates how long a product is able to protect or prevent UV rays that cause sunburn (Yamada et al., 2020).

Efforts to protect human skin from sun exposure can also be done by utilizing several plants that contain antioxidants. There are several plants that contain antioxidants such as suruhan plant. Suruhan plant (*Peperomia pellucida* (L.) Kunth.) is a plant that contains chemical compounds such as alkanoids, flavonoids, saponins, tannins. Flavonoid and tannin compounds in suruhan plants are

antioxidants (Gomes et al., 2022). This plant usually grows in humid areas such as the edge of ditches, damp walls, and in fields. This plant is usually also used by the community to treat various diseases (Imansyah, 2022). Phenolic compounds, especially flavonoids, have potential as sunscreens due to the presence of chromophore groups (conjugated single double bonds) that are able to absorb UV rays, both UV A and UV B, thereby reducing their intensity on the skin (Fonseca et al., 2023). Based on the above background, this research was conducted to determine the sunscreen potential of suruhan plant extract and its antioxidant activity, as well as the stability of the extract in pharmaceutical preparations in the form of cream preparations.

MATERIALS AND METHODS

This study is an experimental research that aims to determine the antioxidant activity value of the extract of Suruhan plant (Peperomia pellucida L. Kunth) used as a sample and its SPF value. As well as the stability of the extract in the formulation of cream preparations. The tools used for this research are analytical scales (Fujitsu), UV-VIS Spectrovotometry (Double Beam PC UVD- 3000® LABOMED, INC), rotary evaporator, 40 mesh sieve and standard lab glassware (Pyrex®).

Materials used include suruhan plant (Peperomia pellucida L. Kunth), DPPH (1,1-diphenyl-2-picrylhydrazyl), 96% ethanol, quarsetin comparator, distilled water, stearic acid, cetyl alcohol, glycerin, TEA, methyl paraben, propyl paraben, and Vanilla Ice fragrance.

Extraction

Suruhan plants were obtained in the Bentiring Permai area, Bengkulu. The part taken from this plant is the old leaves that have dark green or dark green characteristics. This plant was verified at the Biology Lab, Faculty of Mathematics and Natural Sciences, Bengkulu University. Furthermore, the materials were collected and the process of making simplisia was carried out. Simplisia that has been dried (moisture content <10%) is extracted by maceration for 5 days with 96% ethanol solvent. The extract was concentrated at a low temperature of 40 ^{0}C until a thick extract was obtained. The extract is then screened for alkaloid and flavonoid content using qualitative reactions (Wardhani et al., 2023; Wilorianza et al., 2023).

Determination of Antioxidant Activity

DPPH blank solution was made by weighing 19.7 mg of DPPH solids then dissolved using 96% ethanol in a 50 mL volumetric flask until the limit mark so that a DPPH solution with a concentration of 394 ppm was obtained. Suruhan plant extract was weighed as much as 50 mg then dissolved in 96% ethanol in a 500 mL volumetric flask until the limit mark. So as to obtain a test solution with a concentration of 1000 ppm. Furthermore, dilutions were made by making 5 series of solution

concentrations, namely 10 ppm, 50 ppm, 100 ppm, 150 ppm, 200 ppm. As a comparison, quarsetin is used by making a concentration series of solutions, namely 10 ppm, 20 ppm, 30 ppm, 40 ppm, and 50 ppm (Hikmawanti et al., 2021; Yusof, 2019).

The blank solution consists of a mixture of 2 mL DPPH with a concentration of 50 ppm and 2 mL ethanol which is homogenized and incubated for 15 minutes in a dark place, then inserted into a cuvette and measured the absorbance value using uv-vis spectrophotometry at a wavelength of 400-800 nm (Arifin et al., 2022).

The suruhan plant extract was pipetted as much as 2 ml with a volume pipette, then put into a test tube, then added 2 ml of 394 ppm DPPH solution. The mixture was homogenized by using a vortex mixer for about 2 seconds and incubated for 15 minutes in a dark place covered with aluminum foil, then measured the absorbance value using uv-vis spectrophotometry at the maximum wavelength, with replication of 3 times (Arifin et al., 2022).

Determination of SPF Value of Extract

The extract sample was weighed as much as 250 mg and then dissolved with solvent in a 250 mL volumetric flask until the limit mark so that the parent solution with a concentration of 1000 ppm was obtained. Further dilution was done again by making 3 series of solution concentrations, namely 100 ppm, 200 ppm, 300 ppm, 400 ppm and 500 ppm. Determination of sunscreen activity was carried out by measuring the SPF value in vitro using UV-Vis spectrophotometry at a wavelength of 290 to 320 nm with an interval of 5 nm, using 96% ethanol as a blank. The test solution was made in three repetitions (Chunnawong & Pitaksuteepong, 2019; Sari et al., 2022)

The data obtained were processed with the following equation:

SPF = CF x 290∑320 EE (λ) x I (λ) X Absorban (λ)

Description:
CF = Correction Factor (10)
EE = Erythema Effect Spectrum
I = Light Intensity Spectrum
Abs = Absorption of Sunscreen Sample

The value of EE x I is a constant and is determined as in table 1 below:

Table 1: EE(α) x I(α) values

Wavelength (nm)	EE (α) x I (α)
290	0,015
295	0,0817
300	0,2874
305	0,3278
310	0,1864
315	0,0839

320	0,018

Preparation of Cream

Cream making begins with weighing the ingredients. The ingredients for making cream formulations consist of the water phase and the oil phase. The ingredients contained in the water phase are glycerin, methylparaben, TEA, and distilled water which are melted in a vaporizer cup at 70°C (mass I), then those contained in the oil phase, namely stearic acid, cetyl alcohol, and propylparaben are melted at 70°C while stirring until homogeneous (mass II). After that, enter the water phase little by little into the hot mortar containing the oil phase and then crushed quickly until a cream base is formed. After the cream base is formed, the active ingredient of ethanol extract of suruhan plant is added little by little, then fragrance is added and stirred until the cream is homogeneous. The cream that has been formed is then transferred to a storage container (Rizal & Ariyani, 2023).

Table 2: Cream Formulation of Suruhan plant extract

Ingredients	**Concentration (%)**			**Function**
	F0	**F1**	**F2**	
Ethanol extract of suruhan plant		1,15	2,3	Active Substance
Stearic Acid	12	12	12	Emulsifiers
Cetyl Alcohol	0,5	0,5	0,5	Thickener
Glycerin	2	2	2	Moisturizers
TEA	1	1	1	Emulsifier
Methyl Paraben	0,1	0,1	0,1	Preservatives
Propyl Paraben	0,05	0,05	0,05	Preservatives
Vanilla Ice	qs	qs	qs	Fragrance
Aquades ad	100	100	100	Solvent

The cream that has been made is then evaluated which includes organoleptics, homogeneity, pH, Visikosity, and spreadability.

RESULTS AND DISCUSSION

Plant verification was conducted at the Biology Laboratory, Bengkulu University. The results of this verification stated that the plants used in this study were suruhan plants with the scientific name suruhan plant (*Peperomia pellucida* (L.) Kunth) which was stated in Laboratory verification letter Number 277/UN30.28.LAB.BIOLOGY/PP/2024, this was done to ensure the truth of the plants used were suruhan plants.

Figure 1: The suruhan plant

Extraction

In the extraction process using the maceration method because the samples used contain secondary metabolite compounds that cannot withstand high heating, so this method was chosen to prevent damage to the compounds in the sample, besides that this method is also fast, easy to do so that it can draw chemical compounds from the sample very well. The solvent used is 96% ethanol, the reason for choosing 96% ethanol is because it is more selective, non-toxic, good absorption and can prevent the growth of bacteria and fungi (Abubakar & Haque, 2020). Simplisia as much as 800 grams was dissolved with 96% ethanol solvent as much as 8 L, then macerated for 3 days while stirring, then macerated again with 96% ethanol as much as 4 L and for 2 days with occasional stirring. The results of maceration were concentrated using a rotary evaporator at a temperature of 40 0C which aims to separate the solvent and also the extract. The extract of suruhan plant obtained was 20.22 g. The thick extract was screened for secondary metabolite content. The results of the test showed that the extract of suruhan plant contained flavonoids and alkaloids.

Determination of Antioxidant Activity

Testing the antioxidant activity of suruhan plant using the DPPH method.

Table 3: Antioxidant activity test results

No.	Concentration	Abs	% Inhibition	Regression	IC_{50} (µg/mL)	Activity
1	Blanko	0.938				
2	10	0.480	48.827			
3	50	0.479	48.934	y = 0.0447x		
4	100	0.448	52.239	+ 47.7	51.454	strong
5	150	0.425	54.691	R^2 = 0.9674		
6	200	0.407	56.610			
1	Blanko	0.898		y = 0.0461x		
2	10	0.484	46.102	+ 46.854	68.243	strong

3	50	0.461	48.664	$R^2 = 0.7993$		
4	100	0.411	54.232			
5	150	0.410	54.343			
6	200	0.409	54.454			
1	Blanko	0.743				
2	10	0.411	44.684			
3	50	0.386	48.048	y = 3.7281x + 40.471		
4	100	0.359	51.682		80.759	strong
5	150	0.349	53.028	$R^2 = 0.9407$		
6	200	0.291	60.834			
		Average			66.819	strong

The results obtained in the test of 96% ethanol extract of suruhan plant have an antioxidant activity value of 66.819 ppm (Table 3) at a wavelength of 517 nm. The extract is classified into strong antioxidant activity, because the IC50 value obtained is 50-100 ppm, in this study quarcetin as a comparator has an IC50 value of 23.087 ppm which indicates that quarcetin has a very strong antioxidant activity value.

Determination of SPF Value of Extract

Determination of SPF value using UV-Vis spectrophotometric method using a spectrophotometer at a wavelength range of 290-320 nm. The concentration of the sample solution made is 100 ppm, 200 ppm, 300 ppm, 400 ppm, and 500 ppm using 96% ethanol solvent as a diluent and blank solution.

Table 4: Results of Determination of SPF Value of Extract

No.	Extract concentration	Wavelength (nm)	EExI	Abs	(EExI)xAbs	CF	CFx(EExI) xAbs	SPF
1		290	0.0150	0.214	0.0032		0.0321	
2		295	0.0817	0.201	0.0164		0.1642	
3		300	0.2874	0.189	0.0543		0.5432	
4	100ppm	305	0.3278	0.183	0.0600	10	0.5999	1.9002
5		310	0.1864	0.188	0.0350		0.3504	
6		315	0.0839	0.204	0.0171		0.1712	
7		320	0.0180	0.218	0.0039		0.0392	
1		290	0.0150	0.515	0.007725		0.0773	
2		295	0.0817	0.483	0.0394611		0.3946	
3		300	0.2874	0.450	0.12933		1.2933	
4	200 ppm	305	0.3278	0.428	0.1402984	10	1.4030	4.4225
5		310	0.1864	0.426	0.0794		0.7941	
6		315	0.0839	0.448	0.0376		0.3759	
7		320	0.0180	0.469	0.0084		0.0844	

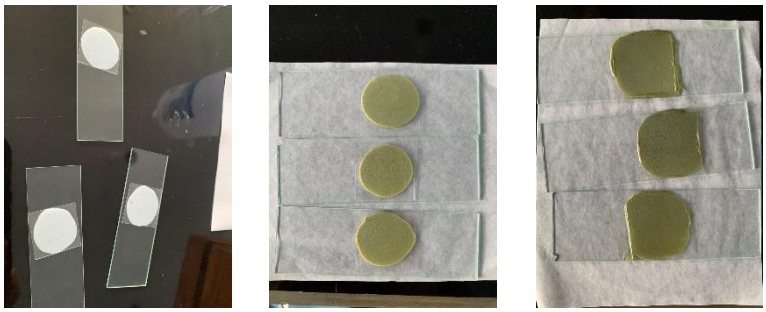
1		290	0.0150	0.698	0.0105		0.1047	
2		295	0.0817	0.649	0.0530		0.5302	
3		300	0.2874	0.600	0.1724		1,7244	
4	300 ppm	305	0.3278	0.563	0.1846	10	1,8455	5.8405
5		310	0.1864	0.556	0.1036		1,0364	
6		315	0.0839	0.583	0.0489		0.4891	
7		320	0.0180	0.612	0.0110		0.1102	
1		290	0.0150	1,002	0.0150		0.1503	
2		295	0.0817	0.932	0.0761		0.7614	
3		300	0.2874	0.861	0.2475		2,4745	
4	400 ppm	305	0.3278	0.806	0.2642	10	2,6421	8.3555
5		310	0,1864	0,792	0,1476		1,4763	
6		315	0,0839	0,828	0,0695		0,6947	
7		320	0,0180	0,868	0,0156		0,1562	
1		290	0.0150	1,198	0.0180		0.1797	
2		295	0.0817	1,116	0.0911		0.9118	
3		300	0.2874	1,030	0.2960		2.9602	
4	500 ppm	305	0.3278	0.965	0.3163	10	3.1633	9.9930
5		310	0.1864	0.947	0.1765		1.7652	
6		315	0.0839	0.986	0.0827		0.8272	
7		320	0.0180	1,031	0.0186		0.1856	

The FDA requires all sunscreens to contain a Sun Protection Factor (SPF). The sun protection index ranges from 2 to more than 50. The results of determining the average SPF value of 96% ethanol extract solution of suruhan plant are presented in Table 4. The average SPF value with a concentration of 100 ppm was 1.9002 (nonprotection), a concentration of 200 ppm was 4.4225 (moderate protection), a concentration of 300 ppm was 5.8405 (moderate protection), a concentration of 400 ppm was 8.3555 (maximum protection), and 500 ppm was 9.9930 (maximum protection). Determination of SPF values in 96% ethanol extract of suruhan plant, both extracts obtained SPF values that increased as the concentration of the sample solution increased. The SPF values of the two extracts indicate that the extracts can be used as sunscreen ingredients that can protect the skin from UV exposure.

Preparation of Cream

In this study, the extract of suruhan plant was formulated into three cream formulas, namely F0 = Cream base, F1 = Cream formula 1 containing 1.15% suruhan plant extract and F2 = Cream formula 2 containing 2.3% suruhan plant extract. In organoleptical testing on the extract, F0 is white and smells aromatic, F1 is green and smells aromatic, F2 is solid green and smells aromatic. From the observation of the homogeneity test on F0 F1, and F2 the extract did not occur separation and homogeneous cream base, it shows that the cream base supports the extract. Homogeneity testing

aims to determine whether the cream preparation is homogeneous or not and when mixed with the extract the cream preparation changes or not.



F0 F1 F2

Figure 2: Homogeneity test

Table 5: pH Test Results

Formula	pH value				Standard
	1st Test	2nd Test	3rd Test	Mean ± SD	
F0	7,54	7,42	7,33	7,43±0,105	4-8
F1	7,48	7,42	7,30	7,4±0,06	4-8
F2	7,39	7,35	7,39	7,37±0,02	4-8

Table 6: Results of the Spreadability Test

Formula	Diameter of spreadability (cm)	Standard (cm)
F0	5,5	5-7
F1	5,3	5-7
F2	5,1	5-7

Table 7: Viscosity Test Results

Formula	Average Viscosity (Cp)	Standard (Cp)
F0	6523	2.000-50.000
F1	3501	2.000-50.000
F2	4919	2.000-50.000

The pH test on cream preparations aims to determine whether or not the preparation is in accordance with the standard pH requirements that are safe for the skin. The pH test complies with the standard with a range limit of 4.5-8. The preparation of suruhan extract cream (*Peperomia pellucida* L. Kunth)

meets the requirements of a preparation that is safe for use on the skin, all pH measurements in Table 5 show a range between 4.5-8. Furthermore, the preparation was tested for spreadability which aims to determine how much the cream spreads when applied to the standard skin in the range of 5-7 cm. In the suruahan extract cream, the diameter of the measurement results is F0 5.5 cm, F1 5.3 cm, and F2 5.1 cm. From the data that has been obtained that the higher the concentration of extracts, the smaller the spread on the skin, because the higher the concentration of extracts, the thicker the cream so that the spread on the skin is smaller. The results of the spreadability test show that the cream meets the requirements of good spreadability.

The viscosity test aims to determine the level of viscosity in a semi-solid preparation. Viscosity testing using NDJ 8S viscometer. The standard value of cream viscosity as a semisolid preparation is 2,000-50,000 Cps. Based on the results of the viscosity obtained in suruhan plant extract cream in F1 amounting to 3501 Cps and in F2 amounting to 4919 Cps. From the results of the viscosity test, we can see in table 7 that the higher the concentration value of the extract, the higher the viscosity value, it shows that the higher the concentration value in the extract, the thicker the cream preparation.

CONCLUSION

Based on the research that has been done, it can be concluded that suruhan plant has the potential as a cream preparation with antioxidant and sunscreen activity, where the antioxidant activity value IC_{50} 66.819 ppm is classified as strong and the SPF value of the extract is classified as maximum protection which increases with increasing extract concentration. From the formulation of cream preparations made, a preparation that is stable in consistency and meets the test requirements is produced.

Acknowledgements

We would like to thank all parties in the D3 Pharmacy Study Program at Unib who have helped this research and the Faculty of Mathematics and Natural Sciences who provided assistance in the form of a grant “Hibah Penelitian Pembinaan PNBP FMIPA UNIB” in 2024 with contract number 2671 /UN30.12/HK/2024.

Declaration of Interest Statement

The authors declare that they have no conflict of interests.

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