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Comparison Of Antioxidant Activity Of Sheet Mask Ethanol Extract Of Kesum Leaves (Polygonum Minus H) Using DPPH And FRAP Methods

Tiara Rizki Ambararum[1)], Annie Rahmatillah[2)], Vivin Marwiyati Rohmana[3)]
[1,2,3)] Bachelor of Pharmacy Study Program, Faculty of Health Sciences, Duta Bangsa University, Surakarta

*Corresponding Author
Email : trizkiambararum@gmail.com

Abstract

Skin aging due to oxidative stress from free radicals requires natural antioxidants such as kesum leaves (Polygonum minus Huds.) which are rich in flavonoids and phenolics. This study aims to formulate a sheet mask from ethanol extract of kesum leaves at a concentration of 1-3%, evaluate the physicochemical properties, and compare antioxidant activity with DPPH and FRAP methods. Quantitative experimental research with a comparative design used purposive sampling of kesum extracts and formulations (F0-F3), with three replications per concentration (a total of 12 samples). Instruments include a UV-Vis spectrophotometer (DPPH 517 nm, FRAP 593 nm), pH meter, viscometer; linear regression data analysis for IC_{50} and t/ANOVA test. The results showed that the IC_{50} extracted DPPH 38.12 ppm (very strong) and FRAP 67.37 ppm (strong); F3 sheet mask optimal IC_{50} DPPH 41.59 ppm, pH 5.43, viscosity 385 mPa.s, spreadability 6.7 cm, non-irritant, increased humidity 50-60%. The DPPH method is more sensitive than FRAP. In conclusion, F3 sheet mask has the potential to be a strong antioxidant for anti-aging cosmetics, in vivo and stability tests are recommended.

Keywords: Antioxidant Activity, Kesum Leaves, Dpph Method, Frap Method, Sheet Mask.

INTRODUCTION

Premature skin aging is triggered by intrinsic and extrinsic factors, causing wrinkles and dark spots as early as the age of 30. As stated, "The aging process, also known as aging, is a biological process that occurs naturally in humans. The aging process in the skin is characterized by rough or scaled skin, dryness, dark spots, dullness, and even wrinkles" (Rizkyah and Karimah, 2023). Endogenous and exogenous free radicals, such as UV, trigger oxidative stress that damages cells.

Sheet masks are a popular skincare cosmetic product due to their practicality and cleanliness, as they are disposable. These masks are made from non-woven fibers using a system of occlusive dressings treatment (Chaniago and Chaeirunisaa, 2023). Antioxidants neutralize free radicals. It works by giving one of its electrons to a free radical compound, thus stopping the destructive activity of the free radical (Rahayu e*t al*., 2021).

Oxidative stress from free radicals poses a cancer risk; natural controls are needed. Kesum leaves are rich in flavonoids and phenols; "Ethanol extract of kesum leaves contains flavonoids, saponins, and tannins" with ethanol 96% has an IC_{50} of10,526 ± 0.075 ppm, a very strong category (Kartikasari*et al*., 2022). A study by Kartikasari (2021) showed that methanol had an IC_{50} of11.164 ± 0.116 ppm.

Kesum activity varies; "The activities varied from 0.39 mg/mL to 29.36 mg/mL, with accession MKSM006 being the strongest (IC50 0.39 mg/mL)" on DPPH and FRAP (Mirfat et al., 2024). Research on kesum sheet masks is limited. Phytochemical screening and DPPH-FRAP comparisons are needed.

Free radicals can be exposed to the environment, such as UV rays, radiation, pollution, cigarette smoke, ozone, and pesticides. Free radicals can also enter through what we consume, such as foods processed at high temperatures, alcoholic beverages, sweetened beverages, or energy drinks (Rahmatillah*et al*., 2025).

Objective: Formulating a sheet mask with kesum leaf extract, testing the extract using the DPPH-FRAP method, and comparing. In this study, the researchers wanted to study and test the potential antioxidant content of ethanol extract sheet masks made from kesum leaves and compare which method was the most effective.

RESEARCH METHODS

Types and Methods of Research

This study used an experimental quantitative approach with a comparative design to compare the antioxidant activity of sheet masks of ethanol extract*Polygonum minus*Huds. kesum leaves using the DPPH and FRAP methods. This type of experimental research was chosen because it allows manipulation of independent variables such as extract concentration (1%, 2%, 3%) on the dependent variable of antioxidant activity, according to Sugiyono who stated "experimental research is research that aims to determine the cause-effect relationship between variables" (Sugiyono, 2022). The location was carried out at the Pharmacy Laboratory of Duta Bangsa University Surakarta and Indonusa Polytechnic Surakarta in January-February 2026.

Data Analysis Instruments and Techniques

The main instruments include a Faithful UV-Vis spectrophotometer for measuring DPPH (516 nm) and FRAP (720 nm) absorbance, a blender, a rotary evaporator, and preparation evaluation tools such as a viscometer and a pH meter. Data analysis techniques include calculating the percentage of inhibition, IC_{50} using linear regression using Microsoft Excel, and independent statistical tests using t-tests or ANOVA to compare the DPPH-FRAP methods. Sudaryono emphasized that "quantitative data analysis involves testing hypotheses through parametric statistics to determine the significance of differences" (Sudaryono, 2021). Data are expressed as mean ± SD with three replications for reliability.

Population and Sample

The study population consisted of all ethanol extracts of Polygonum minus Huds. kesum leaves and sheet mask formulations at concentrations of 0%, 1%, 2%, and 3%, as well as quercetin as a comparison. Samples were taken purposively using four main formulations with three replications per concentration, for a total of 12 antioxidant test samples, as defined by Creswell, who defines "purposive sampling as the selection of participants based on specific characteristics relevant to the research objectives" (Creswell & Creswell, 2022). Plant identification from the laboratory of the Faculty of Biology, University of Tanjungpura, ensured sample homogeneity.

Research Procedures

The procedure begins with the collection of fresh kesum leaves, plant determination, washing, sun/oven drying at 60°C, grinding through a 40 mesh sieve for simple drugs, followed by standardization (yield, water content, ash). Extraction of 70% ethanol maceration (1:10), rotary evaporator drying, phytochemical screening (flavonoids, alkaloids, etc.), sheet mask formulation referring to Fitri*et al*. (2021) with variations in extract concentration, preparation evaluation (organoleptic, pH, viscosity, spreadability, irritation, moisture), as well as DPPH antioxidant tests (0.1 mM methanol solution, 30-minute incubation) and FRAP (0.2 M phosphate buffer pH 6.6, $K_3Fe(CN)_6$ 1%, $FeCl_3$ 0.1%, TCA 10%, 720 nm). Emzir stated that "research procedures must be systematic and sequential to ensure the validity of the results" (Emzir, 2021). Data were analyzed for IC_{50} and method comparison.

RESULTS AND DISCUSSION

Standardization of Simplicia and Determination of Kesum Leaves (Polygonum minus Huds)

Pepicking leaves tosum (Polygonum minus Huds) taken from Jalan Patok 3 Rasau Jaya 1,Rasau Jaya sub-district, Kubu Raya regency, West Kalimantan Province.teThe research was conducted at the Biology Laboratory of the University ofTanjungpura Pontianak. The purpose of the determination is to ascertain the identity of the plants to be studied. Based on the results of the determination, it is ensured that the plants used in thenthis research leaves kesum (Polygonum minus Huds).

The leaf drying processusing an ovenwith a temperature of 60ºC in the Forestry Faculty Laboratory at Tanjungpura University in Pontianak was carried out over 2 days, and the results were obtained.

Table1. Simplisia Yield

Wet Weight (g)	Dry Weight (g)	Yield %
7000	1,225	17.5%
Dry Simplicia Weight (g)	**Weight of Simple Powder (g)**	**Yield %**
1,225	1,143	93.30%

Sourcer : processed research results

On the table 1 obtained yielded simplicia 17.5% of calculationin attachment 9 and rendemenpowder 93.30% Tothen standardization of simple me was carried outcover drying shrinkage, water content test, ash content test.

Drying Shrinkage Test of Simplex

Table 2. Drying Loss of Simple Drugs

Mark %			
Replication 1	**Replication 2**	**Replication 3**	**Mean±SD**
2.67%	2.49%	2.09%	2.42±0.0029

Sourcer : processed research results

Drying shrinkage simple table 2. obtained the value ofwith an average of 2.42 and a standard ofviation 0.0029.

Water Content Test of Simple Drugs

Table 3. Water Content of Simple Drugs

Sample Weight (g)	Replication 1	Replication 2	Replication 3	Mean±SD
2	9.62%	9.06%	8.16%	8.95±0.0073

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On the table 3water content test of simplicia obtained from 3 reapplication ofwith an average of 8.95 and the standard devariance 0.0073.

Ash Content Test of Simple Drugs

Table 4. Ash Content of Simple Drugs

Mark %			
Replication 1	**Replication 2**	**Replication 3**	**Mean±SD**
2.16%	1.79%	2.55%	2.17±0.0038

Sourcer : processed research results

Testing the ash content of simple drugs on the table4 of tothreeThe application obtained an average of 2.17%.

Preparation of Standardized Extract of Kesum (Polygonum minus Huds) Leaf Extract

Table2. Extract Yield

Extract Weight (g)	Dry Simplicia Weight (g)	Yield %
704	1,225	57.46

Sourcer : processed research results

On the table5. Yield extract obtained from the results of thein attachment 9 until the results are obtainedextract 57.46%. Tothen standardization is carried outextractcover drying shrinkage, water content test, and ash content test.

Extract Drying Shrinkage Test

Table 6. Extract Drying Loss

Mark %			
Replication 1	**Replication 2**	**Replication 3**	**Mean±SD**
6.45%	6.93%	5.27%	6.22±0.0085

Sourcer : processed research results

On the table6. Dryingshrinkage test extract obtained % value fromthreeThe application obtained an average value of 6.22 with standard devariance 0.0085.

Extract Water Content Test

Table 7. Water Content of Extract

Sample Weight (g)	Replication 1	Replication 2	Replication 3	Mean±SD
2	7.85%	7.26%	5.09%	6.73±0.0145

Sourcer : processed research results

Onwater content testingextract on the table7 obtained the average result from thethree reapplication, score 6.73with standard devariance 0.0145.

Ash Content Test of Extract

Table 8. Ash Content of Extract

Mark %			
Replication 1	**Replication 2**	**Replication 3**	**Mean±SD**
2.02%	1.73%	1.83%	1.86±0.0014

Sourcer : processed research results

On the table8 ash contentThe extract yielded an average of 1.86with standard valuesvariance 0.0014.

Identification of Chemical Compounds of Kesum Leaves (Polygonum minus Huds)Test Tube Test

Table 9. Phytochemical Screening of Extracts

Compound	Reagent	Observation results	Description	List Library
Alkalod	Mayer	+	White precipitate forms	(Ulfah et al., 2024).
	Dragendorff	+	A precipitate forms and the color changes to orange.	
Flavonoids	Mg powder and 5 drops of concentrated HCl	+	Color changes from orange, red, to brownish	(Novriyanti et al., 2022).
Tannin	A few drops of $FeCl_3$ reagent	+	There is a change in color from blue or blackish green	(Ulfah et al., 2024).
Saponin	Add 5 ml of hot distilled water, then add 1 drop of 2 N HCl	+	The mixture is shaken vigorously until it forms a stable foam for no less than 10 minutes.	(Novriyanti et al., 2022).
Steroid	Plus Lieberman-Bouchard reagent	+	A greenish blue ring is formed	(Ulfah et al., 2024).
Terpenoid	Plus Lieberman-Bouchard reagent	-	No brownish or violet ring is formed.	(Ulfah et al., 2024).
Phenolic	Add 3 drops of 1% $FeCl_3$	+	A purple or blackish blue color is formed	(Kartikasari et al., 2022)

Sourcer : processed research results

Antioxidant Activity Test of Kesum Leaf Extract (Polygonum minus Huds)

Table 10. DPPH operating time

Times	Absorbance
0	0.8296
5	0.8270
10	0.8246
15	0.8221
20	0.8159
25	0.8159
30	0.8159
35	0.8141
40	0.8127
45	0.8119
50	0.8101
55	0.8094
60	0.8085

Sourcer : processed research results

On the table10 obtained operating timestable in retime span 20-30 minutes.

Results of Determination of Wavelength and Operating Time of the FRAP Method(Ferric Reducing Antioxidant Power)

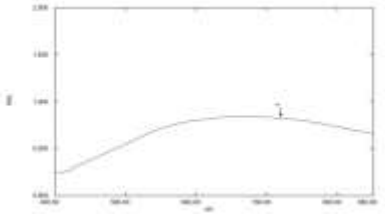

Figure 1. FRAP Antioxidant Wavelength

In figure 1 the length ofFRAP antioxidant pool (Ferric ReInducing Antioxidant Power) the length of is obtainedthe 720 nmwith an absorbance of 0.783.

Table 11. FRAP Operating Time

Times	Absorbance
0	0.7715
5	0.7017
10	0.7734
15	0.7017
20	0.7017
25	0.7017
30	0.7899
35	0.7899
40	0.7692
45	0.7089
50	0.7089
55	0.7715
60	0.7085

Sourcer : processed research results

On the table11 operating timeofwith methodFRAP (Ferric ReInducing Antioxidant Power) have stable time15-25 minutes.

Antioxidant Activity Test of Kesum Leaf Extract (Polygonum minus Huds) DPPH Method (2,2-diphenyl-1-picrylhydrazyl)

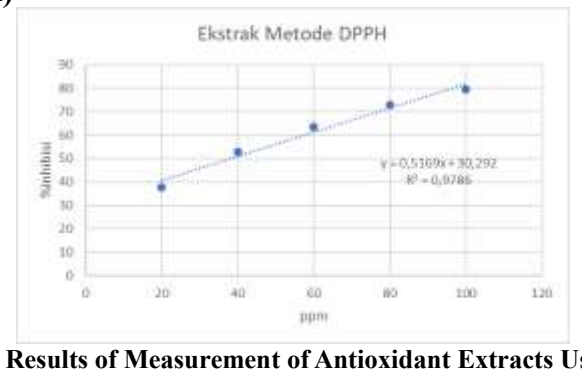

Figure 2. Graph of the Results of Measurement of Antioxidant Extracts Using the DPPH Method

In Figure 2, a graph of the regression value is obtainedextract ofwith usingdpph method, which is as follows y = 0.5169x + 30.292,with an R^2 value of 0.9786.

Table 12. Results of Measurement of Antioxidant Extracts Using the DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.459	0.568	0.633	0.553±0.087	37.82	
40	0.338	0.425	0.495	0.419±0.078	52.88	
60	0.298	0.311	0.367	0.325±0.036	63.44	38.12
80	0.222	0.206	0.298	0.242±0.049	72.80	
100	0.188	0.168	0.190	0.182±0.012	79.55	

Sourcer : processed research results

On the table12 obtained the results of theantioxidant measurementextract ofwith usingdpph method obtained IC_{50} value 38.12 ppm .

Antioxidant Activity Test of Kesum Leaf Extract(Polygonum minus Huds) FRAP (Ferric Reducing Antioxidant Power) Method

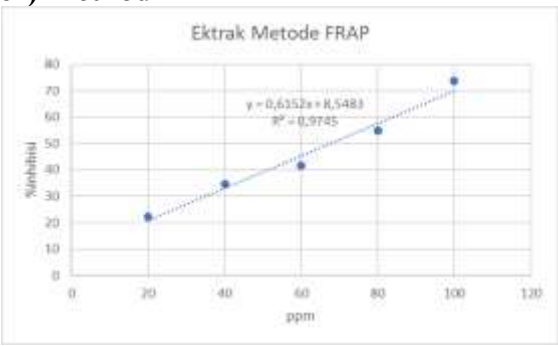

Figure 3. Graph of the Results of Measurement of Antioxidant Extracts Using the FRAP Method

In Figure 3, a graph of the regression value is obtainedextract ofwith usingdpph method, which is as follows y = 0.6152x + 8.5483with an R^2 value of 0.9745.

Table 13. Results of Antioxidant Measurement of Extracts Using the FRAP Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.565	0.574	0.687	0.608±0.067	22.26	
40	0.479	0.482	0.572	0.511±0.052	34.73	
60	0.457	0.448	0.466	0.457±0.009	41.63	67.37
80	0.334	0.367	0.356	0.352±0.016	55.00	
100	0.147	0.229	0.243	0.206±0.051	73.64	

Sourcer : processed research results

On the tablel 13 obtained the results of theantioxidant measurementextract ofwith usingdpph method obtained IC_{50} value 67.37 ppm.

Antioxidant Activity Test of Quercetin as a Comparison of DPPH (2,2-diphenyl-1-picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) Methods

Results of the Antioxidant Activity Test of Quercetin Using the DPPH (2,2-diphenyl-1-picrylhydrazyl) Method

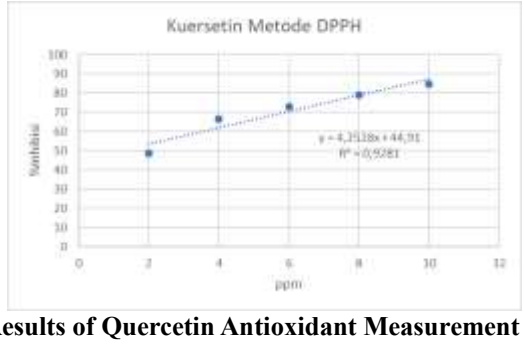

Figure 4. Graph of the Results of Quercetin Antioxidant Measurement Using the DPPH Method

In Figure 5, The regression value graph of quercetin was obtained as a comparison with the extract using the DPPH method, which is as follows y = 4.2528x + 44.91with an R^2 value of 0.9281.

Table 14. Results of Quercetin Antioxidant Measurement Using the DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
2	0.483	0.422	0.465	0.456±0.031	48.68	
4	0.344	0.302	0.251	0.299±0.046	66.40	
6	0.243	0.269	0.207	0.239±0.031	73.07	1.19
8	0.191	0.195	0.172	0.186±0.012	79.10	
10	0.168	0.103	0.133	0.134±0.032	84.86	

Sourcer : processed research results

On the table14 The results of measuring the antioxidant quercetin as a comparison to the extract using the DPPH method yielded an IC_{50} value of 1.19 ppm.

Results of Quercetin Antioxidant Activity Test Using the FRAP (Ferric Reducing Antioxidant Power) Method

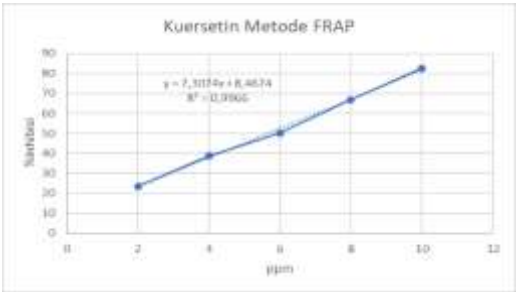

Figure 5. Graph of the Results of Quercetin Antioxidant Measurement Using the FRAP Method

In Figure 5 The regression value graph of quercetin was obtained as a comparison with the extract using theFRAP method, which is as follows y = 7.3074x + 8.4674with an R^2 value of 0.9966.

Table 15. Results of Quercetin Antioxidant Measurement Using the FRAP Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
2	0.615	0.627	0.555	0.599±0.038	23.49	
4	0.514	0.488	0.438	0.480±0.038	38.69	
6	0.499	0.263	0.411	0.391±0.119	50.06	5.68
8	0.316	0.225	0.240	0.260±0.048	66.75	
10	0.132	0.138	0.140	0.136±0.004	82.54	

Sourcer : processed research results

On the table15 The results of measuring the antioxidant quercetin as a comparison to the extract using theFRAP method yielded an IC_{50} value of 5.68 ppm.

Evaluation of Sheet Mask Preparations Using Polygonum minus Huds Leaf Extract

Evaluation testing of kesum leaf extract sheet masks includes organoleptic testing, pH testing, spreadability testing, viscosity testing, irritation testing, moisture testing, and antioxidant activity testing of preparations using the DPPH method.

Organoleptic Test Results

Table 16. Organoleptic Test Results of the Essence Sheet Mask Extract of Kesum Leaves

Formula	Parameter		
	Smell	Color	Form
F0	Typical	White	Thick liquid
F1	Typical	Light yellow	Thick liquid
F2	Typical	Yellow little bitchocolate	Thick liquid
F3	Typical	Yellow to chocolate	Thick liquid

Sourcer : processed research results

On the table16 results peorganole testingptis is obtained from keefour sediaan mehave a distinctive smell, dejust befor sefluid diaan tontal, dewith color in formulation 0, bewhite colorning. Formulation 1, belight yellow color. Formulation 2, byellow colora little bitbrown. Formulation 3, beyellow tobrown.

pH Evaluation Test Results

Table3. pH Test Results of Sheet Mask Preparations

Preparation	Sample			Mean±SD
	Replication 1	Replication 2	Replication 3	
F0	6.41	6.73	6.47	6.53±0.17
F1	5.82	6.04	5.92	5.92±0.11
F2	5.80	5.59	5.48	5.62±0.16
F3	5.40	5.54	5.35	5.43±0.09

Sourcer : processed research results

On the table17 resultspH testing from four preparationswith three-reapplication obtained an average of F0: 6.53with standard devariance 0.17. F1: 5.92with standard devariance 0.11. F2 : 5.62with standard devariance 0.16. And F3: 5.43with standard devariance 0.09.

Spread Power Test Results

Table 18. Results of Spreadability Test of Sheet Mask Preparations

Formulation	Load 50 g			Mean±SD
	Replication 1 (cm)	Replication 2 (cm)	Replication 3 (cm)	
F0	7.6	6.3	5.75	6.55±0.95
F1	5.8	6.1	5.9	5.93±0.15
F2	6.35	6.4	6	6.25±0.21
F3	6.45	6.8	6.85	6.7±0.21

Sourcer : processed research results

On the table18 Dispersibility testing on the four formulations with three replicates was conducted using a 50-gram load, yielding an average value of, F0 : 6.55with standard devariance 0.95. F1: 5.93with standard devariance 0.15. F2 : 6.25with standard devariance 0.21. And F3: 6.7with standard devariance 0.21.

Viscosity Test Results

Table 19. Viscosity Test Results of Sheet Mask Preparations

Formulation	Spindle viscometer no. 4			Average (mP.aS)
	Replication 1	Replication 2	Replication 3	
F0	1128	994	792	971
F1	910	992	991	964
F2	606	818	731	718
F3	411	333	412	385

Sourcer : processed research results

On the table19Viscosity testefour formulations ofwith 3 reapplication obtained the average value of, F0 : 971, F1 : 964, F2 : 718, and F3 : 385.

Irritation Test Results

Table 4.Irritation Test Results

Respondents	Sheet Mask Preparation Formulation			
	F0	F1	F2	F3
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	-	-	-	-

Sourcer : processed research results

Toterangan :

\+ =Teirritation (itching or burning) occursh on the skin)

\- = not tobecome irritated

Humidity Test Results

Table 21. Results of Moisture Testing of Sheet Mask Preparations

Respondents	Formulation	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Average
1	F0	46.8	44.5	49.9	51.4	53.6	54.6	50.1
	F1	47.7	48.9	51.7	52.8	49.5	51.5	50.3
	F2	41.5	45.4	49.1	49.6	55.0	69.6	51.7
	F3	41.6	42.7	45.2	48.6	56.8	62.6	49.5
2	F0	47.5	48.9	52.9	53.0	53.4	62.5	53.0
	F1	50.4	49.1	50.2	54.8	55.3	66.8	54.4
	F2	48.0	50.3	52.8	56.3	57.4	63.1	54.6
	F3	41.2	45.9	45.2	55.3	59.8	79.9	54.5
3	F0	43.1	46.5	46.5	51.9	54.3	68.7	51.8
	F1	41.8	46.0	45.7	52.6	60.1	76.2	53.7
	F2	43.9	47.7	49.5	53.4	64.1	68.8	54.5
	F3	48.4	46.5	47.4	57.4	63.8	60.9	54.0

4	F0	45.3	57.5	59.9	57.5	59.9	56.7	56.1
	F1	44.9	59.8	55.9	59.8	55.9	60.7	54.3
	F2	48.9	55.5	54.8	55.5	54.8	61.5	55.1
	F3	47.6	58.8	63.7	58.8	63.7	84.9	63.9
5	F0	47.5	56.7	54.7	57.0	60.7	70.0	57.7
	F1	55.0	57.2	58.9	54.0	57.7	63.0	57.6
	F2	41.2	45.2	56.2	52.2	58.7	79.5	55.5
	F3	47.8	40.9	48.2	50.8	59.1	80.4	54.5
6	F0	50.5	48.1	49.3	48.6	55.4	79.9	55.3
	F1	43.8	52.2	56.2	58.8	55.5	63.1	54.9
	F2	54.9	58.4	57.5	59.9	56.2	66.8	58.9
	F3	53.1	51.0	57.2	64.0	57.3	62.5	57.5
7	F0	47.8	54.0	54.9	51.9	51.0	57.3	52.8
	F1	49.1	57.0	59.3	52.6	58.8	60.1	56.1
	F2	41.2	52.2	50.8	55.3	54.6	68.7	53.8
	F3	44.8	50.8	54.2	57.3	59.9	76.2	57.2
8	F0	41.1	51.2	6.15	56.2	60.1	64.0	46.4
	F1	40.7	56.7	55.5	53.1	55.9	61.5	53.9
	F2	41.4	46.5	46.6	54.9	59.9	58.4	51.2
	F3	42.7	45.1	52.1	50.5	54.8	52.2	49.5
9	F0	41.8	45.3	47.4	57.6	62.3	83.8	56.3
	F1	47.0	48.8	60.1	62.4	62.5	81.0	60.3
	F2	50.2	52.2	62.5	45.3	60.9	63.3	55.7
	F3	52.5	54.4	64.3	54.6	59.8	58.4	57.3
10	F0	42.3	49.0	49.5	48.6	59.3	85.5	55.7
	F1	45.4	55.6	56.0	57.5	56.7	69.6	56.8
	F2	45.8	49.0	55.0	55.8	54.9	62.0	54.7
	F3	47.9	55.6	53.6	52.3	54.9	54.6	53.1

Sourcer : processed research results

Antioxidant Activity Test of Sheet Mask Preparations Made from Polygonum minus Huds Leaf Extract

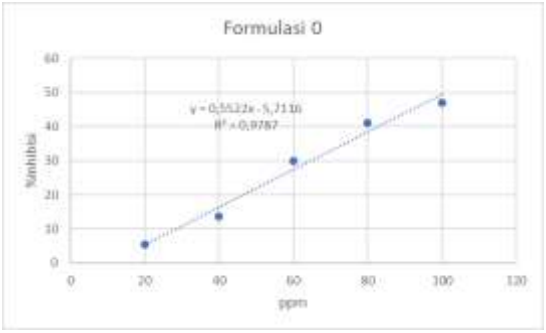

Figure 6. Graph of the Results of Antioxidant Activity Measurement of Formulation 0 DPPH Method

In Figure 6, The regression value graph for formulation 0 using the DPPH method was obtained as follows y = 0.5522x + 5.7116with an R^2 value of 0.9787.

Table 22. Results of Antioxidant Measurement of Formulation 0 DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.840	0.843	0.843	0.842±0.0017	5.39	
40	0.784	0.757	0.762	0.767±0.0143	13.74	
60	0.617	0.624	0.629	0.623±0.0060	29.96	100.89
80	0.524	0.521	0.529	0.524±0.0040	41.04	
100	0.482	0.471	0.463	0.472±0.0095	46.96	

Sourcer : processed research results

on the tablel 22 The antioxidant activity value obtained in the 0 formulation preparation using the DPPH method was IC_{50} 100.89 ppm, Calculationin attachment 23.

Table 5. Results of Antioxidant Activity Measurement of Formulation 1 DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.607	0.590	0.663	0.620±0.0381	30.33	
40	0.581	0.576	0.552	0.569±0.0155	35.99	
60	0.519	0.495	0.487	0.500±0.0166	43.78	73.49
80	0.417	0.438	0.444	0.433±0.0141	51.34	
100	0.339	0.338	0.338	0.338±0.0005	61.98	

Sourcer : processed research results

On the table23 The antioxidant activity value obtained in the 1 formulation preparation using the DPPH method was IC_{50} 73.49 ppm.

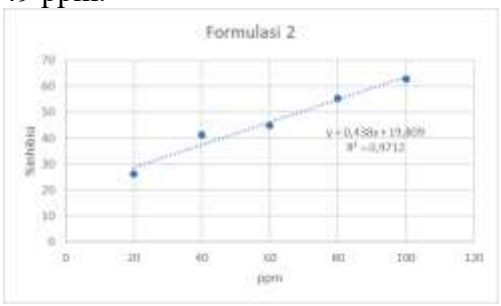

Figure 7. Graph of the Results of Antioxidant Activity Measurement of Formulation 2 DPPH Method

In Figure 7, The regression value graph for formulation 2 using the DPPH method was obtained as follows y = 0.438x + 19.809with an R^2 value of 0.9712.

Table 24. Results of Antioxidant Activity Measurement of Formulation 2 DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.657	0.660	0.655	0.657±0.0025	26.14	
40	0.528	0.524	0.519	0.523±0.0045	41.16	
60	0.493	0.489	0.488	0.490±0.0026	44.94	68.92
80	0.396	0.396	0.400	0.397±0.0023	55.35	
100	0.344	0.332	0.316	0.330±0.0140	62.84	

Sourcer : processed research results

On the table24 The antioxidant activity value obtained in the 2 formulation preparation using the DPPH method was IC_{50} 68.92 ppm.

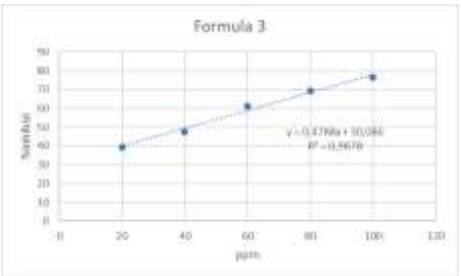

Figure 8. Graph of the Results of Antioxidant Activity Measurement of Formulation 3 Using the DPPH Method

In Figure 8, The regression value graph for formulation 3 using the DPPH method was obtained as follows y = 0.4788x + 30.086with R^2 value = 0.9878, Calculationin attachment 24.

Table6. Results of Antioxidant Activity Measurement of Formulation 3 Using the DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.523	0.582	0.511	0.538±0.038	39.47	
40	0.412	0.493	0.494	0.466±0.047	47.60	
60	0.370	0.344	0.323	0.345±0.023	61.16	41.59
80	0.282	0.283	0.253	0.272±0.017	69.36	
100	0.242	0.207	0.179	0.209±0.031	76.47	

Sourcer : processed research results

On the table25 The antioxidant activity value obtained in the 3 formulation preparation using the DPPH method was IC_{50} 41.59 ppm.

Table 7. Results of Antioxidant Activity Measurement of Comparison Preparations Using the DPPH Method

Concentration (ppm)	Absorbance			Mean±SD	% inhibition	IC_{50}
	Replication 1	Replication 2	Replication 3			
20	0.559	0.5	0.494	0.517±0.035	41.83	
40	0.507	0.457	0.448	0.470±0.031	47.11	
60	0.407	0.382	0.383	0.390±0.014	56.10	46.48
80	0.396	0.368	0.305	0.356±0.046	59.96	
100	0.327	0.314	0.295	0.312±0.016	64.94	

Sourcer : processed research results

On the tablel 26 The antioxidant activity value obtained in the comparative preparation using the DPPH method gets the IC_{50} 46.48 ppm.

DISCUSSION

Standardization of Simplicia and Determination of Kesum Leaves (Polygonum minus Huds)

Determination of kesum plants (Polygonum minus Huds.) from the Polygonaceae family was carried out at the Biology Laboratory of Tanjungpura University, Pontianak to ensure species identity, because identification errors can affect phytochemical content and bioactivity results, with confirmation through letter no. 222 / A / LB / FMIPA / UNTAN / 2025 dated August 7, 2025. Processing started from 6 kg of fresh leaves through wet sorting (sort out dirt, wash, take fresh leaves), dry sorting (separate foreign objects), crushing with a blender, and 40 mesh sieving for particle uniformity, resulting in a dry weight of 1,225 g and a yield of 17.5% simplicia; drying is affected by high water content, so the yield is lower. Quality tests showed a water content of 8.95% (<10% BPOM standard), drying loss of 2.42% (≤10% FHI), and total ash of 2.17% (≤5.6% FHI), all of which meet the standards of the Indonesian Herbal Pharmacopoea and the Indonesian Ministry of Health to ensure purity, compound stability, and prevention of microbial contamination (Ma'ruf et al., 2025; Heru, 2021; Sinaga, 2021).

Preparation of Standardized Extract of Kesum (Polygonum minus Huds) Leaf Extract

Maceration of 1,225 g of kesum leaf (Polygonum minus Huds.) simplicia followed by rotary vacuum evaporation (60°C, 20 Psi) and a 60°C water bath produced 704 g of thick extract with a yield of 57.46%. Extract quality tests showed a water content of 6.73% (≤10% BPOM No.32/2019), drying loss of 6.22% (≤10% FHI), and total ash of 1.86% (<10.7% FHI 2020), thus all meeting the purity and safety standards of traditional medicine (Tandi et al., 2021; Fatimawali et al., 2020; Saeipudin et al., 2024; Krismayadi et al., 2024).

Identification of Chemical Compounds of Kesum Leaves (Polygonum minus Huds)

Chemical compound identification tests on kesum leaf extract (Polygonum minus Huds.) showed positive results for alkaloids (Mayer white precipitate, Dragendorff orange), steroids (Lieberman-Bouchard blue-green ring), saponins (stable foam with 2N HCl), tannins (Fe^{3+} complex), flavonoids (flavilium salts with Mg/HCl), and phenolics (polar soluble); negative for terpenoids, confirming the presence of these bioactive compound groups through their respective characteristic reactions (Nurjannah et al., 2022; Ulfah et al., 2024; Widiawati & Qodri, 2023; Devi et al., 2021; Kartikasari et al., 2022).

Antioxidant Activity Test of Kesum Leaf Extract (Polygonum minus Huds) Using DPPH (2,2-diphenyl-1-picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) Methods

The DPPH test on kesum leaf extract (Polygonum minus Huds.) was optimal at λ 516 nm (absorbance 0.890, stable 20-30 minutes, 0.8159) and 720 nm (stable 15-25 minutes, 0.7017), producing an IC_{50} of 38.12 ppm (very strong, <50 ppm; equation; $y=0.5169x+30.292$, $R^2=0.9786$). The FRAP test showed an IC_{50} of 67.37 ppm (strong, 50-100 ppm; $y=0.6152x+8.5283$, $R^2=0.9745$), with DPPH being superior in capturing strong antioxidant activity via $Fe^{3+} \rightarrow Fe^{2+}$ reduction and radical stabilization (Priangawei et al., 2024; Amaliah et al., 2024; Sitorus et al., 2025;

Antioxidant Activity Test of Quercetin as a Comparison of DPPH (2,2-diphenyl-1-picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power) Methods

Quercetin was chosen as a positive control because it is a natural flavonoid with strong antioxidant activity. In the DPPH test (λ 516 nm), the IC_{50} of quercetin was 1.19 ppm (very strong, <50 ppm); in the FRAP test (λ 720 nm), the IC_{50} was 5.68 ppm (very strong). The lower the IC_{50}, the stronger the activity; DPPH is more effective with low detection, but both methods correlate highly and can be substituted for each other (Ngibad & Leistari, 2020; Sundoro et al., 2024; Amaliah et al., 2024; Elsati et al., 2022).

Evaluation of Sheet Mask Preparations Using Polygonum minus Huds Leaf ExtractOrganoleptic Testing Evaluation

The purpose of the research is toorganoleptic testingis to know how the results of her preparationet mask that is made fromconcentrationextract. Based on the results of theorganoleptik test on negative control preparationhad a clear color(Hanifah e*t al*., 2023).

On the preparation sheet maskextract ethanol leaves kesumconcentration 1%, 2%, 3% Mehave a light yellow to yellow colorchocolateliquid thick texture,Distinctive aroma of blend of tween 80 scentsen and oleum rosae

pH Test Evaluation

pH testpreparation Sheet mask on the table17 seen from the average F0 = 6.53, F1 = 5.92, F2 = 5.62%, F3 = 5.43. The standard pH requirement for skin is 4.5-6.5, a pH value that is too high will cause the skin to become dry, while a pH value that is too low will cause the skin to become irritated and red. The average value shows that each formula produces a good value because it meets the standard requirements(Meirista e*t al*., 2025)

Evaluation of Spread Power Test

On the table18 Spreadpower testpreparation sheet maskleaf kesum extract(Polygonum minus Huds) the results obtained from the average F0 = 6.55 cm, F1 = 5.93 cm, F2 = 6.25 cm, F3 = 6.7 cm. Stated asaccording towiththe requirement is the power valuebaraverage just enter the categorygori 5-7 cm(Nasution e*t al*., 2025).

Viscosity Test Evaluation

Ontable19Viscosity testSheet mask preparationleaf kesum extracts (Polygonum minus Huds) is obtained from the average results of F0 = 971 mP.aS, F1 = 964 mP.aS, F2 = 718 mP.aS, F3 = 385 mP.aS. The results show that the preparation meets the viscosity standards for essence products,namely 230-1150 mPa S(Asanah e*t al.*, 2023).

Irritation Test Evaluation

Irritation testing in table 20 shows that all formulas with various concentrations were tested on 10 panelists. There were no reactions of redness, itching, or swelling. This indicates that sheet masks containing kesum leaf extract (Polygonum minus Huds) can be applied to facial skin.

Moisture Test Evaluation

On the table21 results formula moisture testing.Product good grades becausealready meets the standardrequirements. Skin moisture levels range from <40% (dry), 40%-60% (normal), and >60% (very humid). Value tolemy levels exceeding the specified value will cause skin problems such as acne and blackheads, enlarged pores, and excess oil on the skin, making it feel uncomfortable. Meanwhile, humidity levels below the specified value can cause skin irritation, fine lines, and dull, flaky skin(Farlina e*t al*., 2023).

Evaluation of Antioxidant Activity Testing of Kesum Leaf Sheet Mask Preparation (Polygonum minus Huds)

Antioxidant activity test of the formulation with kesum leaf extract (Polygonum minus Huds.) using the DPPH method (λ 516 nm) showed all strong categories: F0 (without extract) IC_{50} 100.89 ppm ($y=0.5522x–5.7116$, $R^2=0.9787$); F1 (1% extract) IC_{50} 73.49 ppm ($y=0.3933x+21.094$, $R^2=0.9883$); F2 (2% extract) IC_{50} 68.92 ppm ($y=0.438x+19.809$, $R^2=0.9712$); F3 (3% extract) IC_{50} 41.59 ppm ($y=0.4788x+30.086$, $R^2=0.9878$); and comparator IC_{50} 46.48 ppm ($y=0.2953x+36.273$, $R^2=0.9823$),

with activity increasing with extract concentration (Hasnawati et al., 2025; Athaillah et al., 2022; Sitorus et al., 2025; Mawarni et al., 2024).

CONCLUSION

This study successfully formulated a sheet mask of ethanol extract of Polygonum minus Huds. kesum leaves with a concentration of 1-3% that met physicochemical standards (pH 5.4-6.5, viscosity 385-971 mPa.s, spreadability 5.9-6.7 cm, non-irritant, and increased skin moisture by an average of 50-60%). The main findings showed that the extract had very strong antioxidant activity (IC_{50} DPPH 38.12 ppm; FRAP 67.37 ppm), with the most optimal F3 sheet mask (IC_{50} DPPH 41.59 ppm), superior to the comparator (46.48 ppm), and the DPPH method was more sensitive than FRAP. Positive phytochemical screening of flavonoids, alkaloids, saponins, tannins, steroids, and phenolics supported this potential.

However, limitations include a focus solely on DPPH-FRAP without in vivo or long-term stability testing, and variations in local leaf sources that may affect consistency. Suggestions for further research include formula optimization using HPLC for specific compounds, clinical trials, and comparisons with other solvents. Practically, these results support the development of natural cosmetics based on kesum to prevent premature aging, educate the people of West Kalimantan, and contribute to local pharmaceutical science and technology.

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