IJPST
Indonesian Journal of Pharmaceutical Science and Technology

Research Article
Vol. 12 No. 1 (2025): 8-13
https://doi.org/10.24198/ijpst.v12i1.49154

Matoa Leaves (*Pometia pinnata* Forst.) Serum: Physical Characteristics and Antioxidant Activity

Amalia Khairunnisa*, Destria I. Sari, Nani Kartinah, and Happy Limantara
Department of Pharmacy, Lambung Mangkurat University, Banjarbaru, Indonesia

Abstract
Matoa Leaves (*Pometia pinnata* Forst.) has antioxidant activity that inhibits free radicals. This research aims to determine the physical characteristic and antioxidant activity of facial serum Matoa leaves (*P. pinnata* Forst.) with concentrations of the ethanol extract F1 (1%), F2 (3%), and F3 (5%). The physical characteristics tested included organoleptic, homogeneity, pH, viscosity, spreadability, and adhesivity. Antioxidant activity was determined by the DPPH method. The organoleptic results showed that the serum had a yellowish-brown to greenish-brown color, a distinctive aroma of extract, a slightly viscous liquid, and homogeneity. pH test results in F1, F2, and F3 were 6.93±0.02, 5.66±0.02, and 5.05±0.01. Viscosity test results in F1, F2, and F3 were 2983.3±76.3 cP, 3200±50 cP, and 3950.0±50.0 cP. Spreadability test results in F1, F2, and F3 were 5.33±0.05 cm, 5.06±0.05 cm, and 5.03±0.05 cm. Adhesivity test results in F1, F2, and F3 were 1.3±0.04 s, 1.89±0.07 s, and 2.43±0.09 s. Antioxidant activity values in F1, F2, and F3 06.445±2.9 ppm (very weak), 149.464±4.025 ppm (moderate), and 49.204±0.383 ppm (very strong). This research concludes that increasing the concentration of the extract increases color and aroma intensity, viscosity, and adhesivity, and decreases the pH value, spreadability, and IC50 value of facial serum.

Keywords: Antioxidants, Facial serum , *P. pinnata* Forst leaves extract, Physical characteristics.

Article History:
Submitted 10 August 2023
Revised 18 December 2023
Accepted 18 December 2023
Published 28 February 2025

*Corresponding author:
amaliakhairunnisa9293@gmail.com

Citation:
Khairunnisa, A.; Sari, D.I.; Kartinah, N.; Limantara, H. Matoa Leaves (*Pometia pinnata* Forst.) Serum: Physical Characteristics and Antioxidant Activity. Indonesian Journal of Pharmaceutical Science and Technology. 2025: 12 (1), 8 -13.

Serum Daun Matoa (*Pometia pinnata* Forst.) : Karakteristik Fisik dan Aktivitas Antioksidan

Abstrak
P. pinnata Forst. memiliki aktivitas antioksidan yang mampu menghambat radikal bebas. Penelitian ini bertujuan menentukan karakteristik fisik dan aktivitas antioksidan serum wajah daun Matoa (*Pometia pinnata* Forst.) dengan konsentrasi ekstrak etanol pada F1 (1%), F2 (3%), dan F3 (5%). Karakteristik fisik yang diuji meliputi organoleptis, homogenitas, pH, viskositas, daya sebar, dan daya lekat. Aktivitas antioksidan ditentukan dengan metode DPPH. Hasil organoleptis menunjukkan serum berwarna coklat kekuningan-coklat kehijauan, beraroma khas ekstrak, cairan agak kental, dan homogen. Hasil uji pH pada F1, F2, dan F3 sebesar 6.93±0.02, 5,66±0,02, dan 5,05±0.01. Hasil uji viskositas pada F1, F2, dan F3 sebesar 2983,3±76,3 cP, 3200±50 cP, dan 3950±50 cP. Hasil uji daya sebar pada F1, F2, dan F3 sebesar 5.33±0.05 cm, 5,06±0.05 cm, dan 5,03±0.05 cm. Hasil uji daya lekat pada F1, F2, dan F3 sebesar 1,3±0,04 detik, 1,89±0,07 detik, dan 2,43±0,09 detik. Nilai aktivitas antioksidan pada F1, F2, dan F3 sebesar 206,445±2.9 ppm (sangat lemah), 149,464±4,025 ppm (sedang), dan 49,204±0,383 ppm (sangat kuat). Kesimpulan penelitian ini yaitu peningkatan konsentrasi ekstrak meningkatkan intensitas warna dan aroma, viskositas, dan daya lekat, serta menurunkan nilai pH, daya sebar, dan nilai IC_{50} serum wajah.

Kata Kunci: Antioksidan, Ekstrak daun *P. pinnata* Forst, Karakteristik fisik, Serum wajah

1. Introduction

Matoa (*Pometia pinnata* Forst.) is a typical plant from Papua that has been used traditionally in the treatment of fever, hypertension and dysentery, and has potential as an antioxidant. The ethanol extract of *P. pinnata* Forst leaves contains secondary metabolites such as flavonoids, tannins, saponins, steroids, and triterpenoids(1). The ethanol extract of *P. pinnata* Forst leaves showed high antioxidant activity based on the IC_{50} value of 8.622 ± 0.066 ppm.[2] Antioxidants are often found in cosmetic preparations, one of which is facial serum. The serum is a preparation that contains a high concentration of active substances and a low viscosity and can be used by various age groups, from young people to the elderly.[3] Topical cosmetic preparations containing antioxidants can protect the skin from free radicals that cause skin aging.[4] Therefore, this study aims to utilize *P. pinnata* Forst leaves as antioxidants which are developed in facial serum preparations and observed the effect of variations in the concentration of the extract on the physical characteristics and antioxidant activity in facial serum preparations.

2. Materials and Methods

2.1. Tools

The tools used were glass and measuring tools (Pyrex Iwaki Glass), mortar and stamper, magnetic stirrer (Stuart), ultrasonic bath (Bandelin), Buchner funnel, rotary evaporator (IKA RV 10), analytical balance (Ohaus), 25 mesh sieve (Retsch), pH meter (ATC), a set of spreadability and adhesion test equipment, Brookfield viscometer (Type LV), waterbath (Memmert), and UV Visible Spectrophotometer (Perkin Elmer and Genesys 10 UV).

2.2. Materials

The materials used were *P. pinnata* Forst. leaves, 96% ethanol, methanol p.a, xanthan gum (Cosmetic Grade), propylene glycol (Farma Grade), CO_2-free aquadest, DPPH (Smart-Lab), and quercetin standard (Sigma).

2.3. Methods

2.3.1. Extraction

Dissolve P. pinnata leaves simplicia powder with a solvent ratio (1:4), ultrasonicate for 30 minutes (35 kHz) at 50±2°C, incubate for 24 hours, then filter using a Buchner funnel. The filtrate was evaporated to obtain a thick extract with a fixed weight.[5]

2.3.2. Measurement of Antioxidant Activity (IC_{50}) of *P. pinnata* Forst Leaves Ethanol Extract.[6,7]

Quercetin standard concentration series solution, as a comparison, was made at 0.5; 1; 2; 4; and 6 ppm from a 100 ppm solution. Serial concentration solutions of the ethanol extract of *P. pinnata* Forst leaves were prepared at 1, 2, 3, 4, and 5 ppm from a 100 ppm solution. Take 4 mL of each standard and extract concentration, add 1 mL of 0.4 mM DPPH solution, and leave for 26 minutes in a dark place, then measure at λmax.

2.3.3. Preparation and Evaluation of Facial Serum of *P. pinnata* Forst Leaves Ethanol Extract

UKS dilakukan dengan menyuntikkan sebanyak enam Xanthan gum was added to CO_2-free aquadest (1:30) in a beaker glass, then stirred with a magnetic stirrer (400 rpm, 10 minutes). Sodium benzoate is dissolved with CO_2-free aquadest (1:25) and added to a beaker while continuously stirring using a magnetic stirrer. The extract was dissolved in propylene glycol, added to the mixture, and stirred until homogeneous. The remaining CO_2-free aquadest is added up to 100%.[8] Evaluation of facial serum preparations of *P. pinnata* Forst leaves ethanol extract includes organoleptic tests, homogeneity, pH, viscosity, spreadability, and adhesion. Facial serum formulations are shown in Table 1.

2.3.4. Antioxidant Activity Test of *P. pinnata* Forst. Leaves Extract Facial Serum

Prepare a 4000 ppm serum solution in a 10 mL volumetric flask using methanol p.a. The solution was diluted into a series of concentrations of 130, 150, 170, 190 and 210 ppm for formula 1. In formula 2, make a series of concentrations of 70, 90, 110, 130 and 150

Table 1. Formulation of *P. pinnata* Forst Leaves Extract Facial Serum.

Material Name	Material Function	Concentration (%w/w)		
		F1	F2	F3
P. pinnata Forst Leaves Ethanol Extract	Active Ingredients	1	3	5
Xanthan Gum	Viscosity Increaser	1	1	1
Propylene Glycol	Humectant	15	15	15
Sodium Benzoate	Preservative	0.2	0.2	0.2
CO_2 Free Aquadest	Solvent	ad 100 g	ad 100 g	ad 100 g

Table 2. Results of IC_{50} Value of Quercetin and *P. pinnata* Forst Leaves Ethanol Extract.

Sample	Concentration (ppm)	x̄ %Inhibition	Linear Equation	x̄ IC_{50} ± SD(ppm)
Quercetin	0,5	20.006	y=11.6841x + 25.345 r= 0.9568	2.06 ± 0.104
	1	42.336		
	2	58.141		
	4	74.744		
	6	91.680		
P. pinnata Forst Leaves Ethanol Extract	1	2.739	y = 15.1581x – 9.8095 r= 0.9799	3.945 ± 0.036
	2	18.394		
	3	42.483		
	4	53.957		
	5	60.749		

ppm. In formula 3, make a series of concentrations of 10, 30, 50, 70 and 90 ppm. Take 4 mL of the test solution for each concentration and add 1 mL of 0.4 mM DPPH solution. Vortex the solution for 1 minute, incubate the solution in the dark for 26 minutes and measure the absorbance using a UV-Vis spectrophotometer with λmax 515.3 nm.[9]

2.3.5. Data Analysis

The organoleptic and homogeneity test data were analyzed descriptively, while the test data for pH, viscosity, spreadability, adhesivity, and serum antioxidant activity were analyzed statistically using IBM SPSS Statistics 21.The antioxidant activity of the ethanol extract of *P. pinnata* Forst leaves and facial serum was determined based on the IC_{50} value determined by calculating the % inhibition value using the formula[6]:

$$\%\text{Inhibition} = \frac{\text{DPPH Absorbance-Sample Absorbance}}{\text{DPPH Absorbance}} \times 100\%$$

3. Results

3.1. Simplicia Extraction of *P. pinnata* Forst Leaves

The average percent yield of the ethanol extract of *P. pinnata* Forst leaves was 21.01%. Another study obtained the percent yield of *P. pinnata* Forst leaves extract using the maceration extraction method with 96% ethanol solvent were 11.19-14.68%.[10] and 16.68%.[11] The results showed that the extract was brown-black in color, viscous, and had a distinctive aroma of *P. pinnata* Forst leaves and a pH of 10% extract of 5.6.

3.2. Evaluation and physical characteristic of *P. pinnata* Forst Leaves Ethanol Extract Facial Serum

The organoleptic results showed that the serum had a yellowish-brown to greenish-brown color, a distinctive aroma of extract, a slightly viscous liquid, and homogeneity. pH test results in F1, F2, and F3 were 6.93±0.02, 5.66±0.02, and 5.05±0.01. Viscosity test results in F1, F2, and F3 were 2983.3±76.3 cP, 3200±50 cP, and 3950.0±50.0 cP. Spreadability test results in F1, F2, and F3 were 5.33±0.05 cm, 5.06±0.05 cm, and 5.03±0.05 cm. Adhesivity test results in F1, F2, and F3 were 1.3±0.04 seconds, 1.89±0.07 seconds, and 2.43±0.09 seconds

3.3. Determination of antioxidant activity Quercetin and *P. pinnata* Forst Leaves Ethanol Extract (IC_{50})

The average quercetin IC_{50} value was 2.06 ± 0.104 ppm. Several other studies obtained quercetin IC_{50} values of 1.66 ppm.[12] and 2.6 ppm.[13] The IC_{50} value obtained was classified as a very strong antioxidant activity because the IC_{50} value was <50 ppm.[14] The

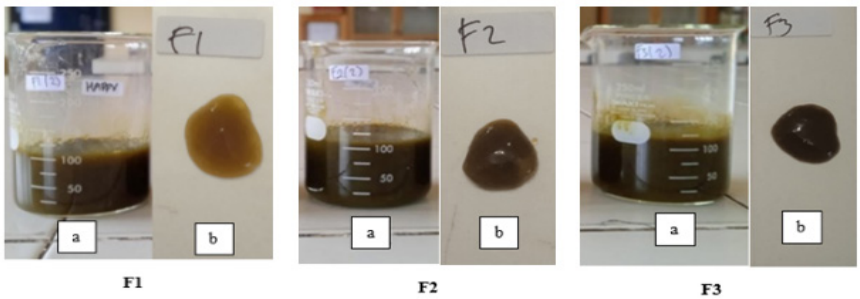

Figure 1. (a) *P. pinnata* Forst Leaves Extract Facial Serum, (b) Samples of Facial Serum Preparations.

Table 3. Organoleptic Test Results and Homogeneity of Facial Serum Ethanol Extract of *P. pinnata* Forst Leaves of F1, F2, and F3.

Formula	Organoleptic Test			Homogeneity
	Color	Aroma	Consistency	
Formula 1	Yellowish Brown	Typical P. pinnata Forst leaves (+)	Slightly Viscous Liquid	Homogeneous
Formula 2	Brown	Typical P. pinnata Forst leaves (++)	Slightly Viscous Liquid	Homogeneous
Formula 3	Greenish Brown	Typical P. pinnata Forst leaves (+++)	Slightly Viscous Liquid	Homogeneous

Information :
(+)⟶ (+++) : The aroma of the facial serum is getting stronger

results of determining the quercetin IC_{50} value can be observed in Table 2. The average IC_{50} value of the extract was 3.945 ± 0.036 ppm. Another study obtained an IC50 value of the ethanol extract of *P. pinnata* leaves of 1.403 ppm.[1] and 8.62 ppm.[2]

3.4. Antioxidant Activity Test of *P. pinnata* Forst Leaves Extract Facial Serum (IC_{50})

The average IC_{50} value of Matoa leaves serum for F1 (1%) was 206.445± 2.9 ppm ; F2 (3%) was 149.464 ± 4.025 ppm and the IC_{50} value of F3 was 49.204 ± 0.383 ppm.

4. Discussion

P. pinnata Forst leaves extract facial serum was made into 3 formulas with extract concentrations in F1 (1%), F2 (3%), and F3 5% (w/w).

The facial serum has a yellowish-brown to greenish-brown color due to the addition of the ethanol extract of *P. pinnata* Forst leaves as an active substance. Formula 3 has the strongest aroma. The increased intensity of the color and aroma of facial serum is due to the increased concentration of the extract added to the formulation. The higher concentration of the extract, the color and aroma of the facial serum will be more concentrated.[15,16] The dosage form of facial serum produced in all formulations is a slightly viscous liquid, due to the concentration of xanthan gum used in the preparations.

The more concentration of the ethanol extract of *P. pinnata* Forst leaves added, the lower the pH value of the facial serum. The ethanol extract of *P. pinnata* Forst leaves contains polyphenolic compounds such as flavonoids that easy to release hydrogen ions and tend to be more acidic.[17] The pH obtained ranges from 5.05-6.39 and has fulfilled the requirements for the pH value of facial skin of 4.5-6.5.[3]

The viscosity value of the facial serum of P. pinnata Forst leaves extract was 2983.3-3950.0 cP. Viscosity values in all formulas have fulfilled viscosity requirements of 2000-4000 cPs.[18] The more extracts added, the more frictional forces that occur between particles in the preparation, thereby increasing the viscosity.[17] The increase in viscosity causes a decrease in the spreadability of the preparation. The spreading power of facial serum was 5.03-5.33 cm. The results for all formulas fulfilled the requirements for the spreadability test, which were 5-7 cm.[19]

P. pinnata Forst leaves extract facial serum has an average adhesion range of 1.3-2.43 seconds. The results have fulfilled the adhesiveness test requirements, which is more than 1 second. The longer the adhesion of the preparation, the active substance contained will last longer on the skin.[20]

The difference in IC_{50} values for extract ethanol matoa leaves was probably caused by differences in the extraction method and the sampling location of *P. pinnata* Forst. leaves which affect the potential antioxidant compounds in the samples. The IC_{50} value obtained was classified as a very strong antioxidant with an IC_{50} value of <50 ppm.[14] The results of determining the IC_{50} value of the ethanol extract of *P. pinnata* Forst leaves can be observed in Table 2.

Based on the IC_{50} value (Table 5), formula 3 has very strong antioxidant activity, formula 2 has moderate antioxidant activity, and formula 1 has very weak antioxidant activity.[14] P. pinnata Forst leaves ethanol extract facial serum starting from a concentration of

Table 4. Results for pH, Viscosity, Spreadability, and Adhesivity Test of *P. pinnata* Forst Leaves Ethanol Extract Facial Serum.

Formula	pH	Viscosity (cP)	Spreadability (cm)	Adhesivity (second)
Formula 1	6.39 ± 0.02	2983.3 ± 76.3	5.33 ± 0.05	1.3 ± 0.04
Formula 2	5.66 ± 0.02	3200.0 ± 50.0	5.06 ± 0.05	1.89 ± 0.07
Formula 3	5.05 ± 0.01	3950.0 ± 50.0	5.03 ± 0.05	2.43 ± 0.09

Table 5. Results of IC50 Value of P. pinnata Forst Leaves Extract Facial Serum.

Sample	Concentration (ppm)	X̄ %inhibition	Linear Equation	IC_{50}±SD (ppm)	Antioxidant Activity
F1 (1% Extract)	130	17.670	y= 0.4524x-43.396 r= 0.992	206.445 ±2.900 ppm	Very Weak
	150	22.055			
	170	32.428			
	190	42.965			
	210	52.457			
F2 (3% Extract)	70	27.956	y=0.277x+8.553 r= 0.998	149.464±4.025 ppm	Moderate
	90	33.871			
	110	38.373			
	130	44.887			
	150	50.174			
F3 (5% Extract)	10	23.003	y=0.589x+20.979 r= 0.985	49.204±0.383 ppm	Very Strong
	30	42.036			
	50	52.342			
	70	63.921			
	90	71.040			

5% has very strong antioxidant activity. The antioxidant activity of the ethanol extract of *P. pinnata* Forst leaves decreased after the formulation process in the form of facial serum. This is due to the addition of several facial serum-forming excipients which interact with the extracts thereby reducing the antioxidant activity of the extracts.

Antioxidant activity will be stronger along with increasing the concentration of the extract as indicated by the decrease in the IC_{50} value.[21] The variations in the concentration of the ethanol extract of *P. pinnata* Forst leaves have a significant effect on the antioxidant activity of facial serum as indicated by the lower IC_{50} value as the concentration of the extract increases.

5. Conclusion

This study concluded that increasing the concentration of the ethanol extract of *P. pinnata* leaves increased the color and aroma intensity, viscosity, and adhesion, and decreased the pH value, spreadability, and IC_{50} value of facial serum.

Conflict of Interest

The authors declare no conflicts of interest.

References

1. Islami D, Anggraini L, Wardaniati I. Aktivitas Antioksidan dan Skrining Fitokimia dari Ekstrak Daun Matoa *Pometia pinnata*. J Farm Higea. 2021;13(1):30.
2. Wulandari L, Nugraha AS, Himmah UA. In Vitro Determination of Antioxidant and Antidiabetic Activity of Matoa Leaves Extract (*Pometia pinnata* J. R. Forst. & G. Forst.). J Kefarmasian Indonesia. 2021;11(2):132–41.
3. Yuniarsih N, Haryani A. Formulasi dan Uji Stabilitas Fisik Serum Wajah Ekstrak Krokot (*Portulaca oleracea* Linn). J Buana Farma. 2022;2(1):6–10.
4. Nuraeni, Sulistijowati RS. Antioxidant And Antibacterial Activities Of Edible Complex Chitosan-Mangrove Fruit Extract *Sonneratia alba*. Jambura Fish Process J. 2021;3(2):51–9.
5. Sari DI, Triyasmono L. Rendemen dan Flavonoid Total Ekstrak Etanol Kulit Batang Bangkal (*Nauclea subdita*) dengan Metode Maserasi Ultrasonikasi. J Pharmascience. 2017;4(1):48–53.
6. Mardiah N, Mulyanto C, Amelia A, Lisnawati L, Anggraeni D, Rahmawanty D. Penentuan Aktivitas Antioksidan dari Ekstrak Kulit Bawang Merah (*Allium ascalonicum* L.) dengan Metode DPPH. J Pharmascience. 2017;4(2):147–54.
7. Bakti AA, Triyasmono L, Rizki MI. Penentuan Kadar Flavonoid Total dan Uji Antioksidan Ekstrak Etanol Daun Kasturi (*Mangifera casturi* Kosterm.) dengan Metode DPPH. J Pharmascience. 2017;4(1):102–8.
8. Wahyuningsih S, Bachri N, Awaluddin N, Andriani I. Serum Wajah Fraksi Etil Asetat Daun Beluntas (*Pluchea* indica L.) sebagai Antibakteri. J Katalisator. 2021;6(2):270–83.
9. Taufik I, Indra, Nurdianti L. Formulasi dan Evaluasi Aktivitas Antioksidan Metode DPPH pada Sediaan Spray Gel *β* -Karoten. J Pharmacopolium. 2021;1(1):1–10.
10. Sutomo, Hasanah N, Arnida, Sriyono A. Standardisasi Simplisia dan Ekstrak Daun Matoa (*Pometia pinnata* J . R Forst & G . Forst) Asal Kalimantan Selatan. J Pharmascience. 2021;08(01):101–10.
11. Rismiasih A, Justicia AK. Uji Aktivitas Tabir Surya Ekstrak Etanol Daun Matoa (*Pometia pinnata*) Secara In Vitro. J Komunitas Farm Nas. 2022;2(1):215–32.
12. Sudarmanto I, Suhartati T. Aktivitas Antioksidan Senyawa Flavonoid pada Kulit Akar Tanaman Ara (*Ficus racemosa*, L). J Kesehatan. 2015;6(2):137–41.
13. Adawiyah R, Rizki MI. Aktivitas Antioksidan Ekstrak Etanol Akar Kalakai (*Stenochlaena palustris* Bedd) Asal

Kalimantan Tengah. J Pharmascience. 2018;5(1):71–7.
14. Pangestu NS, Nurhamidah N, Elvinawati E. Aktivitas Antioksidan dan Antibakteri Ekstrak Daun *Jatropha gossypifolia* L. Alotrop. 2017;1(1):15–9.
15. Thomas AN, Tungadi R, Papeo DRP, Makkulawu A, Manoppo YS. Pengaruh Variasi Konsentrasi Ekstrak Buah Mahkota Dewa (*Phaleria macrocarpa*) terhadap Stabilitas Fisik Sediaan Krim. Indonesian J Pharm Educ. 2022;2(2):143–52.
16. Dipahayu D, Lestari KAP. Evaluasi Fisik Masker Anti Jerawat Dengan Ekstrak Etanol Daun Ubi Jalar Ungu (*Ipomoea batatas* (L.) Varietas Antin-3. J Pharm Sci. 2021;6(2):69–73.
17. Tahalele E, Sutriningsih. Formulation Cream Cosmetic Preparations of Matoa (*Pometia pinnata*) Leaves Extract and Test Activity Antioxidant. Indonesia Nat Res Pharm J. 2018;3(2):44–55.
18. Kusumawati AH, Oktavia DN, Wahyudi D, Sandini M, Romli NR, Gunarti NS, et al. Formulasi dan Evaluasi Fisik Sediaan Serum Wajah Ekstrak Beras Merah (*Oryza nivara* L.). J Pharmacopolium. 2022;5(2):223–9.
19. Liandhajani, Fitria N, Ratu AP. Karakteristik dan Stabilitas Sediaan Serum Ekstrak Buah Kersen (*Muntingia calabura* L.) dengan Variasi Konsentrasi. J Farmamedika (Pharmamedica Journal). 2022;7(1):17–27.
20. ilarso DP, Maghfiroh A, Amira KJ. Pengaruh Gelling Agent pada Sediaan Serum Jerawat Kombinasi Ekstrak Daun Sirih Hijau dan Buah Belimbing Wuluh. J Farm Indonesia. 2022;3(1):1–7.
21. Hehakaya MO, Edy HJ, Siampa JP. Formulation and Antioxidant Activity Test of Body Scrub Matoa's Leaves (*Pometia pinnata*). Pharmacon. 2022;11(4):1778–85.