

Analysis of antioxidant and standardization of ethanol extract rumput mutiara (*Oldelandia corymbosa* L.)

By Irma Erika Irma

Analysis of antioxidant and standardization of ethanol extract rumput mutiara (*Oldelandia corymbosa* L.)

Irma Erika Herawati^{1*}, Imillah Saepudin²

¹Program Studi Pendidikan Apoteker, Sekolah Tinggi Farmasi Indonesia

²Program Studi Farmasi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas al-Ghifari

Submitted : Reviewed : Accepted:

ABSTRACT

The majority of traditional medicinal plants in Indonesia lack scientific validation. Scientific assessment, in conjunction with traditional knowledge, is crucial for acquiring effective pharmaceuticals for commercial use. *Oldelandia corymbosa* L., also known as rumput mutiara, is a member of the Rubiaceae family and has been utilized as a traditional medicinal plant for the treatment of various ailments. Purpose of this study was to evaluate the quality of both non-specific specific parameters and to analyze the antioxidant activity of rumput mutiara. Antioxidant activity was evaluated with 1-diphenyl-2-picrylhydrazyl (DPPH). The findings for non-specific parameters indicated that the shrinkage drying of the extract and the water content were $18.00 \pm 0.000\%$ and $12.20 \pm 0.000\%$, respectively. Simultaneously, particular parameters indicate that the extracts possess a distinct odor, exhibit a blackish-brown hue, and display a viscous consistency. Microscopic parameters of rumput mutiara simplicia showed fragments such as anthers, leaf mesophyll, epidermis and stomata, transport bundles, stem parenchyma, and sclerenchyma. Specific parameters, such as the water-soluble content, and ethanol-soluble compounds were $72.00 \pm 0.000\%$ and $35.00 \pm 0.000\%$, respectively. In addition, TLC profiles showed that secondary metabolites of extract were 6 alkaloids, 5 phenolics, 5 flavonoids, 5 tanins, 3 saponins, 5 steroid, and 5 glycosides. The extract has strong antioxidant activity with IC_{50} value of $14.11 \pm 0.008 \mu\text{g/mL}$.

Keywords: rumput mutiara, non-specific parameters, specific parameters, antioxidant, DPPH.

Corresponding author:

Name: Irma Erika Herawati
Affiliation of author: Sekolah Tinggi Farmasi Indonesia
Address. Soekarno Hata 354 Bandung, Jawa Barat
Email: irmaerika@stfi.ac.id
No Hp: 081322240508

INTRODUCTION

Rumput mutiara (*Oldenlandia corymbosa* L.) is a member in the Rubiaceae that has been utilized as a traditional medicinal plant. The plant is noted for its ability to eliminate heat and toxins, stimulate blood circulation, promote diuresis, and alleviate stranguria (urinary obstruction). It is also known to be effective against digestive tract malignancies, lymphosarcoma, and liver and laryngeal carcinoma. Appendicitis, hepatitis, pneumonia, cholecystitis, urinary infections, cellulites, and snake bites are also treated with it (Patel et al., 2014).

To maintain their qualities, medicinal plants need ways to prove their identification, purity, and quality. One way to regulate the quality of raw materials derived from medicinal plants is through standardisation. The process from standardisation is a quality assurance technique that ensures that the parameters of medicinal plants remain constant (Muhtadi & Ningrum, 2019).

Seeing the many benefits and uses of rumput mutiara in society, a standard is needed to ensure the content of rumput mutiara. The goal of this research was to uncover specific and non-specific features for herbal medicinal compounds as indicated by the Indonesian Ministry of Health and the National Agency of Drug and Food Control Republic of Indonesia (Badan POM RI). Non-specific parameters such as shrinkage drying, and water content were measured. Extract identity and organoleptic evaluation, microscopic identification, determination of compound dissolved in certain solvents, phytochemical screening, and chromatogram profile are some of the specific characteristics. The antioxidant activity of the extract was also examined using the DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay in this study.

MATERIALS AND METHOD

Materials

Rumput mutiara herbs were collected from Kebun Pelembagaan Manoko, Cikahuripan, Lembang, Kabupaten Bandung Barat, Jawa Barat. The plants were identified at the Plant Taxonomy Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Padjadjaran University, Jatinangor, West Java, with number authentication HB/06/2022, which claimed that the plant used was rumput mutiara (*Oldenlandia corymbosa* L.). Ethanol and DPPH were analytical grade and bought from Sigma-Aldrich (St. Louis, USA).

Extraction

The herbs of rumput mutiara were macerated using 70% ethanol as the solvent for 3x24 h. The process was applied by changing the solvents every 24 hours. Then, the collected extracts were evaporated in a rotary vaporator at 40–50 °C until the extracts acquired their constant volume (Kusuma et al., 2017).

Shrinkage drying measurement

A closed, preheated weighing container that had been previously weighed while empty was filled with one gramme of extract. With the lid open, the extract is put in the oven at 105 °C. Weighing bottle is positioned in the desiccator until it reaches room temperature. This procedure is performed iteratively until a constant weight is achieved, defined as a variation of no more than 0.0005g between successive weighings (Departemen Kesehatan, 2000).

Water content

Three grams of the extract are enclosed in aluminum foil and placed in a dry round-bottom flask. Fifty milliliters of toluene is introduced into the flask via a vertical condenser and heated cautiously for one hour. The interior of the cooler is washed with toluene. Water and toluene droplets are observed until they are fully separated, at which point the water volume is measured (Departemen Kesehatan, 2000).

Extract identity and organoleptic evaluation of extracts

The extract identification encompasses a nomenclatural description, alternative designations of the plant, including its Indonesian name, and the specific plant parts utilized. The assessed organoleptic qualities encompass the extract's color, aroma, and flavor (Departemen Kesehatan, 2000).

Microscopic identification of simplicia from rumput mutiara

The powder of rumput mutiara herbs is positioned on a glass object, treated with a chloral hydrate solution, and sealed with a cover glass. The substance was further heated using a Bunsen burner with tube clamps, maintained below boiling point, until completely dry. The specimens were subsequently examined under a microscope at a magnification of 10x (Departemen Kesehatan, 2000).

Identifying the substances that dissolve in particular solutions

The weight of the rumput mutiara herbs was 1.5 grams. The samples were designated as extract A and extract B, and two weigh-ins were performed. While Extract B is macerated for 24 hours with 50 mL of 96% ethanol, Extract A was macerated for 24 hours with 50 mL of water-chloroform in a sealed flask. After filtering the maceration products, 10.0 mL of the filtrate was evaporated in a cup with a fixed empty weight. The residue is heated 105 °C until a constant weight is achieved (Departemen Kesehatan, 2000).

Phytochemical screening

Using phytochemical screening, which involves examining alkaloids, flavonoids, saponins, steroids, tannins, triterpenoids, and glycosides, the chemical components in the ethanol extract of rumput mutiara plants are identified (Nur et al., 2022).

Chromatographic profile

The ethanol extract of rumput mutiara plants was manually spotted using a capillary tube on precoated silica gel GF254 plates of 15x5 cm with a thickness of 3 mm for the isolation of various phytochemical components. The spotted plates were placed in a solvent system to identify the appropriate mobile phase according to the procedure of Karthika et al. (2014), as detailed in Table 1. Following the separation of phytochemical ingredients, chemicals such as Dragendorff reagent and 5% ferric chloride were employed to identify the corresponding compounds. The color of the dots was recorded, and Rf values were computed using the subsequent formula:

$$\text{Retention factor (Rf)} = \frac{\text{distance travelled by the solute}}{\text{distance travelled by the solvent}} \dots (1)$$

Table 1. TLC system and spray reagent for determination secondary metabolite

Substances	Mobile Phases	Spraying Reagents	Color of the spot
Alkaloids	Chloroform: Methanol (3:2)	Dragendroff	Orange/ Brown
Polyphenols	Chloroform: Methanol (7: 3)	FeCl ₃	Blackish blue
Flavonoids	Ethylacetate: Methanol: Water: Glacial acetic acid (1,7: 0,5: 0,5: 0,5)	FeCl ₃	Grey

Judul manuskrip (Penulis pertama)

Tanins	Chloroform: Ethylacetate: Methanol (5: 3: 3)	FeCl ₃	Blackish blue
Saponins	Kloroform: Metanol (2,2: 0,5)	Vanillin H ₂ SO ₄ reagent	Violet Blue
Steroids	n-hexane: Ethylacetate (1,5: 0,5)	Vanillin H ₃ PO ₄ reagent	Blue
Glycosides	Ethylacetate-ethanol-water (8:2:1.2)	H ₂ SO ₄	Pinkish Violet

Antioxidant activity assay

A 40-ppm DPPH solution was combined with 96% ethanol and left to incubate in the dark for 20 minutes. The absorbance was quantified within the range of 400 to 700 nm. Ascorbic acid and Rumpup mutiara extract were solubilized in 96% ethanol and subsequently diluted to five distinct quantities. Each sample (1 mL) was combined with 2 mL of DPPH solution and subsequently incubated for 20 minutes. Absorbance was quantified at the peak wavelength, and inhibition was determined using formula 2. The IC₅₀ value was calculated from a linear regression analysis of inhibition against concentration (Saptarini & Herawati, 2018).

$$\%inhibition = \frac{Abs\ DPPH - Abs\ sample}{Abs\ DPPH} \times 100\% \quad \dots (2)$$

RESULT AND DISCUSSION

The current research employed maceration method, using 70% ethanol. During maceration process, ethanol will permeate the simplicia cell wall and then penetrate the plant cell cavity, which houses the active constituents. The extraction solution will solubilize the secondary metabolites from plant. Because of its potential to increase cell wall permeability and make it easier to extract both polar and non-polar components, ethanol was selected as the solvent. The concentrated fluid was expelled from the cell due to the disparity in active component concentration between the intracellular and extracellular environments (Kusuma et al., 2017). The extract yield from this research was 10.39%.

Non-specific parameters that have been studied in this research include shrinkage drying and moisture measurement from simplicia and extract. Information about the range of values of compounds lost during the drying process is intended to be provided by the drying shrinkage parameter. In the meanwhile, simplicia and extract quality and storage capacity are correlated with water content.

Table 2. The characterization of non-specific parameters from rumpup mutiara

Parameters (%)	Specimens	
	Simplicia	Extract
Shrinkage drying	7.5	18.00 ± 0.000
Water content	4.4	12.20 ± 0.000

n=2

Shrinkage drying and water content from simplicia do not surpass 10%, whereas the thick extract category has a water content range of 5–30%. According to **Table 2**, both simplicia and extract comply with the standards set by the Indonesian Herbal Pharmacopoeia.

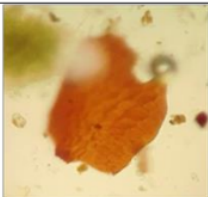
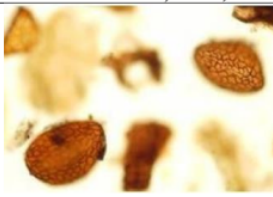
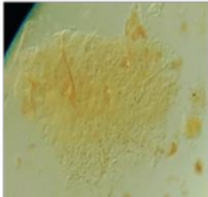
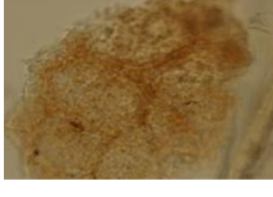
Identifying extract and organoleptic properties is a particular criterion that aims to provide objective information about material identity by just introducing materials. The parameter must be determined to provide an objective identify based on the compound's name and specific identity. The organoleptic features of the ethanolic extract of rumpu mutiara were studied. **Table 3** presents the outcomes of assessments on form, color, aroma, and flavor.

Table 3. The identification and organoleptic characteristics of rumpu mutiara

Parameters	Characteristics
Identity	
Scientific name for plants	<i>Oldelandia corymbosa</i> L.
Used parts	Whole parts
Indonesian name plants	Rumpu mutiara
Organoleptic	
Form	Thick
Color	Blackish-brown
Smell	Specific
Taste	Bitter

The objective of utilizing a microscope to analyze rumpu mutiara plant powder is to identify the characteristics of herb identification pieces. The chloral hydrate solution is designed to eliminate cellular components including protein and starch, hence enhancing the visibility of cellular identifying fragments in the herbs under a microscope (Fatmawati et al., 2021). **Table 4** illustrates the existence of anthers, leaf mesophyll, epidermis and stomata, vascular bundles, stem parenchyma, and sclerenchyma in the simplicia of rumpu mutiara plant.

Table 4. Microscopic fragments from rumpu mutiara

Microscopic Parameter	Observation	Citation (Herbal Pharmacopoeia of Indonesia, 2017)
Anthers		
Mesophyll of leaves		



The purpose of the dissolved compound levels' parameter⁴ is to reveal the kind of chemical compounds present in the extract. Water and ethanol are the two types of solvents that are used. Ethanol dissolves semi-polar and non-polar compounds, whereas water acts as a solvent for polar molecules (Muhtadi & Ningrum, 2019).

Table 5. Water And Alcohol Soluble Compounds of Rumput Mutiara

Parameter	Characteristics
Water soluble compounds	72.00 ± 0.000 %
Ethanol soluble compounds	35.00 ± 0.000 %

n=2

Table 5 indicates that rumput mutiara exhibits greater solubility in water compared to ethanol. The findings indicated that the compounds present in rumput mutiara extract are polar. The polar extract of rumput mutiara contains compounds including flavonoids, tannins, and anthraquinones (Selvan, 2015; Ezeabara, 2016).

Phytochemical screening reveals the constituents of plant extracts, identifying predominant components, and aids in the discovery of chemical compounds suitable for the development of effective pharmaceuticals. The color changes resulting from a reaction with a particular response are

observed qualitatively during phytochemical screening. The objective of this phytochemical screening is to determine the secondary metabolite content of the simplicia and extracts.

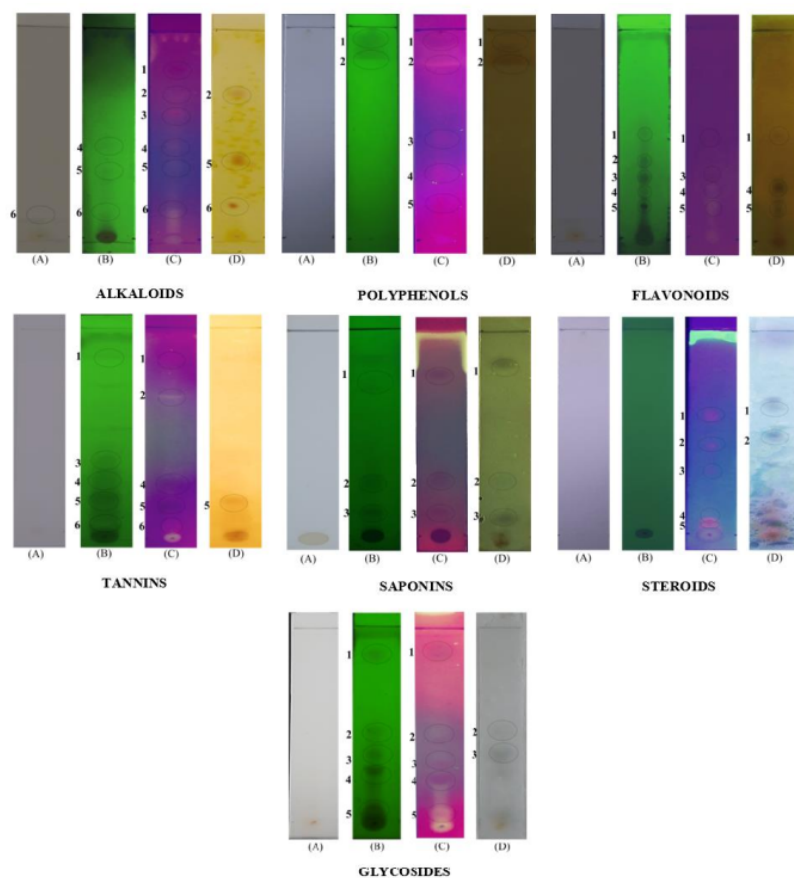
Table 6. Results of identification of secondary metabolites of rumput mutiara.

Phytochemical Test	Simplicia	Extract	TLC
Alkaloids	+	+	+
Phenolics	+	+	+
Flavonoids	+	+	+
Tannins	+	+	+
Saponins	+	+	+
Steroids	+	+	+
Glycosides	+	+	+

*(+) = positive test (exist); (-) = negative test (not exist)

Table 6 presents the findings of the phytochemical screening. Phytochemical screening results indicate that rumput mutiara exhibits antioxidant activity owing to the presence of phenolic and flavonoid compounds.

Medicinal plants are rich in secondary metabolites, with alkaloids, flavonoids, glycosides, saponins, and terpenoids being particularly significant among the several bioactive compounds. The chromatographic method is the most often employed technique for the separation of plant constituents among the several accessible approaches.



23
Figure 1. TLC profile on observations under (A) Visible; B (UV 254 nm); C (UV 366 nm); D (Dragendorff for alkaloids); D (FeCl₃ for polyphenols, flavonoids, and tannins); D (Vanillin in H₂SO₄ for Saponin); D (Vanillin in H₃PO₄ for steroids); D (H₂SO₄ for glycosides)

Table 7. Rf values of rumput mutiara extract on various secondary metabolites

Compounds	Spot	Visible	UV 254 nm	UV 366 nm	Dragendorff	Prediction Metabolites
Alkaloids	1	-	-	0.82	-	Alkaloids 1
	2	-	-	0.7	0.7	Alkaloids 2
	3	-	-	0.58	-	Alkaloids 3
	4	-	0.52	0.52	-	Alkaloids 4
	5	-	0.38	0.38	0.38	Alkaloids 2
	6	0.14	0.14	0.14	0.14	Alkaloids 5

	Spot	Visible	UV 254 nm	UV 366 nm	FeCl ₃	Prediction Metabolites
Polyphenols	1	-	0.9	0.9	0.9	Polyphenols 1
	2	-	0.85	0.85	0.85	Polyphenols 2
	3	-	-	0.42	-	Polyphenols 3
	4	-	-	0.28	-	Polyphenols 4
	5	-	-	0.14	-	Polyphenols 40
Flavonoids	1	-	0.5	-	0.5	Flavonoids 1
	2	-	0.4	-	-	Flavonoids 2
	3	-	0.37	0.37	-	Flavonoids 3
	4	-	0.28	0.28	0.28	Flavonoids 4
	5	-	0.14	0.14	0.14	Flavonoids 5
Tannins	1	-	0.94	0.94	-	Tannins 1
	2	-	-	0.8	-	Tannins 2
	3	-	0.71	-	-	Tannins 3
	4	-	0.38	0.38	-	Tannins 4
	5	-	0.17	0.17	0.17	Tannins 5
	6	-	0.08	0.08	-	Tannins 6
	Spot	Visible	UV 254 nm	UV 366 nm	Vanillin in H ₂ SO ₄	Prediction Metabolites
Saponins	1	-	0.7	0.7	0.7	Saponin 1
	2	-	0.28	0.28	0.28	Saponin 2
	3	-	0.14	0.14	0.14	Saponin 3
	Spot	Visible	UV 254 nm	UV 366 nm	Vanillin in H ₃ PO ₄	Prediction Metabolites
Steroids	1	-	0.5	0.5	0.5	Steroids 1
	2	-	0.32	0.32	0.32	Steroids 2
	3	-	0.15	-	-	Steroids 3
	4	-	0.07	-	-	Steroids 4
	5	-	0.04	-	-	Steroids 5
	Spot	Visible	UV 254 nm	UV 366 nm	H ₂ SO ₄	Prediction Metabolites
Glycosides	1	-	0.92	0.92	-	Glycosides 1
	2	-	0.57	0.57	0.57	Glycosides 2
	3	-	0.4	0.4	0.4	Glycosides 3
	4	-	0.28	0.28	-	Glycosides 4
	5	-	0.1	0.1	-	Glycosides 5

The ethanolic extract of rumpup mutiara was analyzed using thin-layer chromatography (TLC), and various mobile phase compositions were investigated to isolate diverse secondary metabolites, including alkaloids, phenolics, flavonoids, tannins, saponins, steroids, and glycosides (Table 1, Figure 1). The samples were spotted on TLC plates that had been prepared in a suitable solvent system. The samples were applied to TLC plates prepared with an appropriate solvent solution. The color developed and was observed upon derivatization with the appropriate spraying reagent. Secondary metabolites were segregated according to color, and R_f values were assessed as presented in Table 7.

The TLC examination revealed the presence of alkaloids, phenolics, flavonoids, tannins, saponins, steroids, and glycosides in various solvent compositions, exhibiting diverse Rf values in the ethanolic extract of rumput mutiara (Table 7). In a study by Aprianto (2018), ursolic acid was detected in the ethanol extract of pearl grass following treatment with a 10% sulfuric acid reagent, resulting in the formation of purple spots. A comprehensive phytochemical analysis of rumput mutiara reveals the presence of proteins, polysaccharides, polyphenols, tannins, flavonoids, saponins, steroids, triterpenes, and glycosides (Das et al., 2019). Gosh et al (2018) investigated the plant pigments in rumput mutiara, revealing variations in total pigments among different herbs, including chlorophyll-a, chlorophyll-b, total chlorophyll, and total carotenoids.

Alkaloids are predominantly biosynthesized from amino acids, yielding a diverse array of chemical structures, most of which are derived from plants. Alkaloids function in both human medicine and an organism's innate defense mechanisms. Alkaloids comprise approximately 20% of the total identified secondary metabolites present in plants. Alkaloids are recognized for their medicinal applications as anesthetics, cardioprotective agents, and anti-inflammatory medications. Morphine, strychnine, quinine, ephedrine, and nicotine are prominent alkaloids employed in medical applications (Heinrich et al., 2021). This research identified six categories of alkaloids with diverse Rf values.

Polyphenols are a vast category of compounds generated from secondary metabolism, present throughout the plant kingdom. Polyphenolic acids, coumarins, flavonoids, stilbenes, and lignans exemplify polyphenols. Additional polymerized forms, including tannins and lignans, have been included. Some of them are responsible for the aroma, color, and antioxidant properties of the fruits, vegetables, seeds, and nuts we consume. Polyphenols are increasingly vital owing to their health-enhancing attributes. Moreover, their significance as natural antioxidants in the prevention and management of cancer, inflammatory, cardiovascular, and neurological diseases (Hano & Tungmunthum, 2020). This study identified five kinds of polyphenols with differing Rf values.

Flavonoids exemplify secondary metabolites found in various fruits, vegetables, herbs, stems, cereals, nuts, flowers, and seeds. Flavonoids possess biochemical and antioxidant properties that are advantageous in several diseases, including cardiovascular disorders, cancer, and neurological ailments. Flavonoids are scientifically associated with numerous health advantages and are vital in various nutraceutical, pharmacological, therapeutic, and cosmetic uses. This is primarily attributable to their anti-inflammatory, antioxidant, anti-carcinogenic, and anti-mutagenic properties, together with their capacity to regulate essential cellular enzyme activities (Chen et al., 2023). This research identified five types of flavonoids with distinct Rf values.

Tannins are astringent polyphenolic compounds derived from plants, commonly located in different parts of herbs. As a polyphenol, tannin has a variety of therapeutic and medical uses, in addition to antioxidant capabilities, thereby demonstrating a range of pharmacological effects, including anti-toxic, anticancer, antiallergic, anti-inflammatory, anthelmintic, antimicrobial, antiviral, wound healing, and dysentery treatment, among others (Sharma et al., 2021). This research identifies five varieties of tannins with differing Rf values.

Saponins are a class of bioorganic molecules prevalent in the plant kingdom. They are naturally occurring glycosides that exhibit soap-like foaming properties, resulting in foam formation when agitated in aqueous solutions. Saponins have biological functions and therapeutic properties, including hemolytic activity, anti-inflammatory, antibacterial, antifungal, antiviral, insecticidal, anticancer, cytotoxic, and molluscicidal effects, as documented in the literature. Moreover, saponins have demonstrated the ability to lower cholesterol levels in both animals and people (El Aziz et al., 2019). The ethanolic extract of rumput mutiara exhibited three distinct forms of saponins, each with varying Rf values.

Steroids are unique compounds present in the plant that have considerable physiological effects on plant growth, development, and reproduction. Plant steroids are a category of physiologically active secondary metabolites characterized by gonane carbon skeletons of 5 α and 5

41
β configurations. Steroids in plants are classified into categories based on biological roles, structures, and synthesis mechanisms. All subtypes' antiviral, anti-inflammatory, immunomodulatory, and anti-cancer characteristics have been investigated. (Yerlikaya et al., 2023). This study has identified five types of 50 steroids.

Plants synthesize a diverse array of secondary metabolites that may be glycosylated. The glycosylation of metabolites in plants fulfills many tasks. Hydrophobic metabolites exhibit increased water solubility 16 following glycosylation, enhancing their biodistribution and metabolic processes. The improved solubility and amphiphilicity of glycosy 16 d metabolites may promote their translocation across cellular membranes. Glycosylation can generate a non-toxic molecule that may subsequently be reactivated and employed as an aglycone for protection against parasites and herbivorous organisms (Kytidou et al., 2020). Among the results, five locations were identified as glycosides.

46
DPPH method is sensitive, rapid, and straightforward technique for assessing antioxidant 6 activity of plant extracts. The modification of DPPH solution demonstrated antioxidant action. The 51 PH solution changes color from purple to yellow, with the intensity corresponding to the quantity of moles of the stabilized molecule. The literature indicates that maximum wavelength of the DPPH solution is 515.0 nm (Figure 2). Transmitted color at this wavelength is green (500-520 nm). (N. Saptarini et al., 2019).

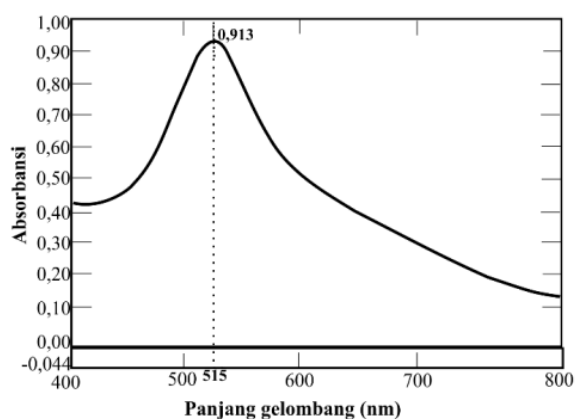


Figure 2. DPPH Wavelength in Spectrophotometer UV-Vis

Table 8. Results of the antioxidant activity of rumpit mutiara extract

Sample	Concentrati on (ppm)	Absorbance ± Standard Deviation (SD)	Inhibition (%)	Linear Regression	IC ₅₀ (µg/mL)
Vitamin C (standar d)	1	0.462 ± 0.006	49.39	y=4.6025x+44.593	1.17 ± 0.016
	2	0.408 ± 0.023	53.78		
	3	0.359 ± 0.003	58.21		
	4	0.321 ± 0.034	62.63		
	5	0.275 ± 0.004	67.99		
Extract	10	0.468 ± 0.011	48.74	y = 0.235x + 46.429	14.11 ± 0.008
	30	0.417 ± 0.005	54.33		
	50	0.375 ± 0.004	58.93		
	70	0.325 ± 0.011	64.40		

Judul manuskrip (Penulis pertama)

90	0.283 ± 0.004	69.00
(n=3)		

This study selected vitamin C as a control due to its efficacy as an antioxidant, which neutralizes oxidative stress through electron donation or transfer mechanisms. Vitamin C can diminish unstable radicals of oxygen, nitrogen, and sulfur, while also restoring other antioxidants inside the body. Furthermore, human plasma experiments have demonstrated that vitamin C is helpful in reducing lipid peroxidation caused by peroxide radicals (Caritá et al., 2020).

The antioxidant activity of rumput mutiara extract was inferior to that of vitamin C, the positive control, due to the extracts not being pure components, as illustrated Table 8.

Awe et al., (2013) classify antioxidant activity based on the IC₅₀ value as very strong (<50 µg/mL), strong (50-100 µg/mL), medium (100-150 µg/mL), or weak (150-200 µg/mL). Antioxidant activity rumput mutiara extract is exceptionally robust, with an IC₅₀ of 14.11 µg/mL, equivalent to vitamin C.

Extract's elevated antioxidant activity results from the presence of secondary metabolites, including phenolics and flavonoids (Sasikumar et al., 2009). According to prior research by Sasikumar et al. (2009), antioxidant assays utilizing DPPH exhibited a strong correlation with total phenolic and flavonoid concentration. This study's findings indicate that rumput mutiara possesses the potential to be developed into an antioxidant preparation.

CONCLUSION

The standardization of rumput mutiara extracts, conducted in accordance with established health department protocols, demonstrated that all metrics satisfied the requisite standards. The TLC examination of rumput mutiara extract revealed the presence of alkaloids, phenolics, flavonoids, tannins, saponins, steroids, and glycosides across several solvent compositions with differing Rf values. The antioxidant activity was demonstrated by IC₅₀ values of 14.11 ± 0.008 µg/mL, indicating robust antioxidant efficacy.

ACKNOWLEDGEMENT

The authors express gratitude to thank Ita Inayah and Ira Rahmawati for their technical assistance in this research.

REFERENCES

- Awe, F.B., Fagbemi, T.N., Ifesan, B.O.T. & Badejo, A.A. (2013). Antioxidant properties of cold and hot water extracts of cocoa, Hibiscus flower extract, and ginger beverage blends. *Food Research International*. 52(2): 490-495
- Bronte, V., & Pittet, M. J. (2013). The Spleen in Local and Systemic Regulation of Immunity. *Immunity*, 39(5), 806-818. <https://doi.org/10.1016/j.immuni.2013.10.010>
- Caritá, A. C., Fonseca-Santos, B., Shultz, J. D., Michniak-Kohn, B., Chorilli, M., & Leonardi, G. R. (2020). Vitamin C: One compound, several uses. Advances for delivery, efficiency and stability. *Nanomedicine: Nanotechnology, Biology and Medicine*, 24, 102117. <https://doi.org/10.1016/j.nano.2019.102117>
- Chen, S., Wang, X., Cheng, Y., Gao, H., & Chen, X. (2023). A Review of Classification, Biosynthesis, Biological Activities and Potential Applications of Flavonoids. *Molecules*, 28(13), 4982. <https://doi.org/10.3390/molecules28134982>
- Departemen Kesehatan. (2000). *Parameter Standar Umum Ekstrak Tumbuhan Obat*.
- El Aziz, M. M. A., Ashour, A. S., & Melad, A. G. (2019). A review on saponins from medicinal plants: chemistry, isolation, and determination. *Journal of Nanomedicine Research*, 8(1), 282-288.
- Fatmawati, A., Sucianingsih, D., Kurniawati, R., & Abdurrahman, M. (2021). Microscopic Identification and Determination of Total Flavonoid Content of Moringa Leaves Extract and Ethyl Acetate Fraction (*Moringa oleifera* L.). *Indonesian Journal of Pharmaceutical Science and Technology*, 1(1), 66-74.

- Ghosh P, Das P, Mukherjee R, Banik S, Karmakar S, Chatterjee S. Extraction and Quantification of Pigments from Indian Traditional Medicinal Plants: A Comparative Study between Tree, Shrub, and Herb, International Journal of Pharmaceutical Sciences and Research. 2018, 9(7):3052-3059, 0975-8232.
- Hano, C., & Tungmunthum, D. (2020). Plant Polyphenols, More than Just Simple Natural Antioxidants: Oxidative Stress, Aging and Age-Related Diseases. *Medicines*, 7(5), 26. <https://doi.org/10.3390/medicines7050026>
- Heinrich, M., Mah, J., & Amirkia, V. (2021). Alkaloids Used as Medicines: Structural Phytochemistry Meets Biodiversity—An Update and Forward Look. *Molecules*, 26(7), 1836. <https://doi.org/10.3390/molecules26071836>
- Karthika K, Jamuna S, & Paulsamy S. (2014). TLC and HPTLC Fingerprint Profiles of Different Bioactive Components from the Tuber of *Solena amplexicaulis*. *Journal of Pharmacognosy and Phytochemistry JPP*, 3(31), 198–206. <http://www.phytojournal.com/archives/2014/vol3issue1/PartD/27.1-435.pdf>
- Kusuma, S., Herawati, I., & Yuliasih, N. I. (2017). In vitro antifungal activity of the orange jasmine (*Murraya paniculata* [L.] Jack) leaves ethanol extract from Indonesia against *Candida albicans*. *Int J Sci Eng Appl Sci*, 273–278.
- Kytidou, K., Artola, M., Overkleeft, H. S., & Aerts, J. M. F. G. (2020). Plant Glycosides and Glycosidases: A Treasure-Trove for Therapeutics. *Frontiers in Plant Science*, 11. <https://doi.org/10.3389/fpls.2020.00357>
- Muhtadi, M., & Ningrum, U. (2019). Standardization of durian fruit peels (*Durio zibethinus* Murr.) extract and antioxidant activity using DPPH method. *Pharmaciana*, 9(2), 271. <https://doi.org/10.12928/pharmaciana.v9i2.12652>
- Nur, R. M., Dewi, R., & Kaliu, S. (2022). Antibacterial activity of methanol extract *Rhizophora mucronata* leaves toward *Salmonella typhi*: leading the typhoid fever. *Pharmaciana*, 12(3), 364. <https://doi.org/10.12928/pharmaciana.v12i3.22475>
- Nurkhasanah, Minangsari, D. N. I., & Yulianny, V. A. (2016). The combination of rosella (*Hibiscus sabdariffa* L.) and Stevia (*Stevia rebaudiana*) extracts increase the antioxidant activity and stability. *International Journal of Pharmacy and Pharmaceutical Sciences*, 8(5), 7–8.
- Nurkhasanah, Nurani, L. H., & Hakim, Z. R. (2017). Effect of rosella (*Hibiscus sabdariffa* L.) extract on glutathione-S-transferase activity in rats. *Tropical Journal of Pharmaceutical Research February*, 16(10), 2411–2416.
- Patel, T., Jain, V., & Dodia, R. (2014). *Oldenlandia corymbosa* L.: A Phytopharmacological review. *International Journal of Phytopharmacy*, 4(3), 79–82.
- Saptarini, N. M., & Herawati, I. E. (2018). The Effect Acetic Acid On Total Anthocyanins Content and Antioxidant Activity of Tamarillo (*Solanum betaceum* Cav.). *Journal of Pharmacy Research*, 12, 398–401.
- Saptarini, N., Rahayu, D., & Herawati, I. (2019). Antioxidant activity of crude bromelain of pineapple (*Ananas comosus* (L.) Merr) crown from Subang district, Indonesia. *Journal of Pharmacy And Bioallied Sciences*, 11(8), 551. https://doi.org/10.4103/jpbsJPBS_200_19
- Sasikumar JM, Maheshu V, Aseervatham GS, Darsini DT. In vitro Antioxidant Activity of *Hedyotis corymbosa* (L.) Lam. Aerial Parts. *Indian Journal of Biochemistry & Biophysics*, 2010, 49-52.
- Sharma, K., Kumar, V., Kaur, J., Tanwar, B., Goyal, A., Sharma, R., Gat, Y., & Kumar, A. (2021). Health effects, sources, utilization and safety of tannins: a critical review. *Toxin Reviews*, 40(4), 432–444. <https://doi.org/10.1080/15569543.2019.1662813>
- Sulistiyani, N., & Nurkhasanah. (2017). The cytotoxic effect of *Elephantopus scaber* Linn extract against breast cancer (T47D) cells The cytotoxic effect of *Elephantopus scaber* Linn extract against breast cancer (T47D) cells. *IOP Conference Series: Materials Science and Engineering*, 1–6. <https://doi.org/10.1088/1757-899X/259/1/012006>
- Ukoha, U., Mbagwu, S. I., Ndukwe, G. U., & Obiagboso, C. (2015). Histological And Biochemical Evaluation of The Kidney Following Chronic Consumption Of *Hibiscus sabdariffa*. *Advances in Biology*, 1–5.
- Yerlikaya, P. O., Arisan, E. D., Mehdizadehtapeh, L., Uysal-Onganer, P., & Gürkan, A. (2023). The Use of Plant Steroids in Viral Disease Treatments: Current Status and Future Perspectives. *European Journal of Biology*, <https://doi.org/10.26650/EurJBiol.2023.1130357>

Analysis of antioxidant and standardization of ethanol extract rumpu mutiara (*Oldelandia corymbosa* L.)

ORIGINALITY REPORT

24%

SIMILARITY INDEX

PRIMARY SOURCES

- | | | |
|---|--|----------------|
| 1 | journal.uad.ac.id
Internet | 227 words — 6% |
| 2 | eprints.uad.ac.id
Internet | 69 words — 2% |
| 3 | www2.mdpi.com
Internet | 43 words — 1% |
| 4 | "Natural Product Experiments in Drug Discovery",
Springer Science and Business Media LLC, 2023
Crossref | 32 words — 1% |
| 5 | repository.unfari.ac.id
Internet | 31 words — 1% |
| 6 | journals.lww.com
Internet | 26 words — 1% |
| 7 | Erindyah Retno Wikantyasning, Tianur Tri Wahyuni. "Optimization and Formulation of Skin Lotion Containing Butterfly Pea () Flower Extract and Study on its Antioxidant Activity ", BIO Web of Conferences, 2024
Crossref | 23 words — 1% |
| 8 | Abubakar M. Bello, Ibrahim S. Malgwi, Salami H. Adegoke, Abdulwasi'u Abubakar, Bilal M. Ibrahim, Samaila M. Chiroma. "Oral acute toxicity study on stem bark | 21 words — 1% |

extracts of *Bombax costatum* Pellegr. and Vuillet on wistar albino rats", Bulletin of the National Research Centre, 2022

Crossref

-
- | | | |
|---|--|----------------|
| 9 | cms.turkjps.org
<small>Internet</small> | 21 words — 1 % |
|---|--|----------------|
-
- | | | |
|----|--|----------------|
| 10 | tjnpr.org
<small>Internet</small> | 21 words — 1 % |
|----|--|----------------|
-
- | | | |
|----|---|----------------|
| 11 | www.irjmets.com
<small>Internet</small> | 21 words — 1 % |
|----|---|----------------|
-
- | | | |
|----|---|------------------|
| 12 | catalog.iyte.edu.tr
<small>Internet</small> | 20 words — < 1 % |
|----|---|------------------|
-
- | | | |
|----|---|------------------|
| 13 | Amanda Costa Caritá, Bruno Fonseca-Santos, Jemima Daniela Shultz, Bozena Michniak-Kohn et al. "Vitamin C: One compound, several uses. Advances for delivery, efficiency and stability", Nanomedicine: Nanotechnology, Biology and Medicine, 2020
<small>Crossref</small> | 19 words — < 1 % |
|----|---|------------------|
-
- | | | |
|----|--|------------------|
| 14 | Juan Zhang, Hong-Xi Xu, Zhi-Li Zhao, Yan-Fang Xian, Zhi-Xiu Lin. "Dendrobium nobile Lindl: A Review on Its Chemical Constituents and Pharmacological Effects", Chinese Medicine and Culture, 2021
<small>Crossref</small> | 19 words — < 1 % |
|----|--|------------------|
-
- | | | |
|----|--|------------------|
| 15 | repository.usu.ac.id
<small>Internet</small> | 19 words — < 1 % |
|----|--|------------------|
-
- | | | |
|----|--|------------------|
| 16 | Kassiani Kytidou, Marta Artola, Herman S. Overkleeft, Johannes M. F. G. Aerts. "Plant Glycosides and Glycosidases: A Treasure-Trove for Therapeutics", Frontiers in Plant Science, 2020
<small>Crossref</small> | 16 words — < 1 % |
|----|--|------------------|

17 Shaza H. Aly, Abdullah M. M. Elbadry, Mohamed El-Shazly, Tsong-Long Hwang. "Exploring the potential role of genus Sophora in the management of osteoporosis: a phytochemical and biological review", Frontiers in Natural Products, 2023

Crossref

16 words — < 1 %

18 ojs.stfmuhammadiyahcirebon.ac.id

Internet

16 words — < 1 %

19 doi.org

Internet

14 words — < 1 %

20 repository.stfi.ac.id

Internet

14 words — < 1 %

21 repository.ubaya.ac.id

Internet

14 words — < 1 %

22 Bel Youssouf G. Mountessou, Alain W. Ngouonpe, Alexis Sylvain W. Mbobda, Eric O. Akintemi et al. "Structural analysis and molecular docking study of pachypodostyflavone: A potent anti-onchocerca", Journal of Molecular Structure, 2023

Crossref

13 words — < 1 %

23 123dok.com

Internet

12 words — < 1 %

24 H.M.S.K.H. Bandara, A.G.A.W. Alakolanga, N.R. Amarasinghe, N.K.B. Adikaram, L. Jayasinghe, Y. Fujimoto. "Antiviral Activities of Some Traditional Medicinal Plants of Sri Lanka", Current Traditional Medicine, 2023

Crossref

12 words — < 1 %

25 dokumen.tips

Internet

12 words — < 1 %

-
- 26 www.ncbi.nlm.nih.gov 12 words — < 1 %
Internet
-
- 27 journals.ui.edu.ng 11 words — < 1 %
Internet
-
- 28 Ainun Fawaid, Nurkhasanah Mahfudh. "Chemical Compound Profile of Bajakah Kalalawit (*Uncaria gambir* Roxb) Stem Extract Using Liquid Chromatography High-Resolution Mass Spectrometry", *Borneo Journal of Pharmacy*, 2025 10 words — < 1 %
Crossref
-
- 29 Kjell Briseid Jensen. "Comparison by a Chemical Method of Different Drug Extraction Procedures for Biological Standardisation of *Digitalis* Leaves.", *Acta Pharmacologica et Toxicologica*, 03/13/2009 10 words — < 1 %
Crossref
-
- 30 biointerfaceresearch.com 10 words — < 1 %
Internet
-
- 31 repository.unair.ac.id 10 words — < 1 %
Internet
-
- 32 www.science.gov 10 words — < 1 %
Internet
-
- 33 www.scirp.org 10 words — < 1 %
Internet
-
- 34 Kartik Sharma, Vikas Kumar, Jaspreet Kaur, Beenu Tanwar, Ankit Goyal, Rakesh Sharma, Yogesh Gat, Ashwani Kumar. "Health effects, sources, utilization and safety of tannins: a critical review", *Toxin Reviews*, 2019 9 words — < 1 %
Crossref
-
- 35 ijpsr.com Internet

9 words — < 1 %

36 japsonline.com
Internet

9 words — < 1 %

37 www.mdpi.com
Internet

9 words — < 1 %

38 www.researchgate.net
Internet

9 words — < 1 %

39 www.skums.ac.ir
Internet

9 words — < 1 %

40 Fatima Zohra Hechaichi, Hamdi Bendif, Chawki Bensouici, Sulaiman A. Alsalamah et al.
"Phytochemicals, Antioxidant and Antimicrobial Potentials and LC-MS Analysis of Centaurea parviflora Desf. Extracts",
Molecules, 2023
Crossref

8 words — < 1 %

41 dokumen.pub
Internet

8 words — < 1 %

42 ds.guilford.edu
Internet

8 words — < 1 %

43 journal.uin-alauddin.ac.id
Internet

8 words — < 1 %

44 publikasiilmiah.unwahas.ac.id
Internet

8 words — < 1 %

45 repository.bku.ac.id
Internet

8 words — < 1 %

46 www.pharmainfo.in
Internet

8 words — < 1 %

47 www.thepharmajournal.com 8 words — < 1 %
Internet

48 Ariyanti Saputri, Sofa Fajriah, Antonius Herry
Cahyana, Devi Kasih Putria, Ziyen Saputra, Marissa
Angelina. "PHYTOCHEMICAL PROFILES, ANTIOXIDANT, AND
ANTICANCER ACTIVITIES FROM LEAVES AND SEEDS EXTRACT OF
Myristica fragrans", Jurnal Kimia Riset, 2024 6 words — < 1 %
Crossref

49 Christophe Hano, Duangjai Tungmunthum.
"Plant Polyphenols, More than Just Simple Natural
Antioxidants: Oxidative Stress, Aging and Age-Related
Diseases", Medicines, 2020 6 words — < 1 %
Crossref

50 Rangan Mitra, Suparna Ghosh, Goutam
Mukherjee, Avik Acharya Chowdhury. "Chapter 11-
1 Secondary Metabolites: Treasure Trove for Future Medicine",
Springer Science and Business Media LLC, 2023 6 words — < 1 %
Crossref

51 Zahra Marissa, Soraya Mita, Cahya Kusumawulan,
Sriwidodo Sriwidodo. "Antioxidant and
Photoprotective Activity of Bromelain Cream: An In Vitro and In
Vivo Study", Cosmetics, 2025 6 words — < 1 %
Crossref

EXCLUDE QUOTES OFF
EXCLUDE BIBLIOGRAPHY ON

EXCLUDE SOURCES OFF
EXCLUDE MATCHES OFF