

The Effect of Solvent Variation on Antioxidant Activity in Red Fruit Extract (*Pandanus Conoideus Lam*) Using UV-Visible Spectrophotometry

Liwen Vinesia Bilat Werluka¹, Ratih Arum Astuti², AM Muslihin³

Program Studi Farmasi Fakultas Farmasi Universitas Pendidikan Muhammadiyah Sorong, Sorong, Indonesia, Jl. KH Ahmad Dahlan No.01, Mariyat Pantai, Aimas Kabupaten Sorong, Papua Barat Daya- 98418.

This study aims to determine the effect of different solvents on the antioxidant activity of red fruit seed extract (*Pandanus conoideus Lam*). It was analysed using the DPPH assay and UV-Vis spectrophotometry. Samples were extracted using the maceration method with various solvents, namely 96% ethanol, n-hexane, and ethyl acetate. The yield results showed that ethanol, n-hexane, and ethyl acetate extracts yielded 18%, 12%, and 11%, respectively. Phytochemical screening tests showed that ethanol extracts contained flavonoids, alkaloids, tannins, and saponins. The n-hexane extract contained alkaloids, while the ethyl acetate extract contained alkaloids and saponins. Antioxidant activity was assessed based on the IC₅₀ value of the ethanol extract, which showed antioxidant activity with an IC₅₀ value of 54.67 µg/mL, categorised as a very strong antioxidant. The ethyl acetate extract had an IC₅₀ value of 19.92 µg/mL, categorised as strong, while the n-hexane extract showed the highest IC₅₀ of 9.40 µg/mL, categorised as very strong. These differences indicate that solvent polarity affects the amount and type of bioactive compounds extracted, thereby affecting the ability to capture free radicals. Thus, these results indicate that n-hexane solvent provides the strongest antioxidant activity in red fruit seed extracts.

Keywords: Red Fruit, Maseration, Antioxidant, DPPH.

This is an open access article under the [CC BY-NC](#) license



Corresponding Author:

Liwen Vinesia Bilat Werluka
Universitas Pendidikan Muhammadiyah Sorong
Jl. KH Ahmad Dahlan No.01, Mariyat Pantai, Aimas Kabupaten Sorong, Papua Barat Daya - 98418
Werluka
werlukaliwen@gmail.com

1. Introduction

Indonesia is one of the countries with the greatest biodiversity in the world, including more than 30,000 plant species that grow in tropical forests (Study et al., 2024). Of these, around 9,600 species have been identified as having potential as medicinal plants and are used traditionally by the community (Nugroho, 2017). One of Papua's endemic plants with high economic and health value is the red fruit (*Pandanus conoideus Lam*), which has long been used as a source of food and traditional medicine (Purwaningsih et al., 2023).

Red fruit seeds are known to contain various secondary metabolites, including flavonoids, alkaloids, tannins, and tocopherols, which act as antioxidants (Khairani dan Indriani, 2024). Antioxidants are compounds that play a role in protecting and suppressing cell damage caused by free radicals produced by oxidative stress. These compounds work by neutralising free radicals, converting them into non-toxic metabolic by-products that can then be effectively excreted by the body. Regular consumption of fruits and vegetables rich in antioxidants can help reduce the risk of various diseases triggered by free radical activity (Hardiansyah et al., 2024). Free radicals are unstable molecules that have one unpaired electron in their outer orbital, making them highly reactive. This reactivity is due to their high ability to interact with and bind electrons from cellular molecules (Hardiansyah et al., 2024). These antioxidant compounds work by neutralising free

The Effect of Solvent Variation on Antioxidant Activity in Red Fruit Extract (*Pandanus Conoideus Lam*) Using UV-Visible Spectrophotometry. Liwen Vinesia Bilat Werluka et.al

radicals that can potentially damage cells and trigger various degenerative diseases (Parlindungan dan Sugito, 2018). Free radicals can originate from within the body, including as a result of cellular respiration, metabolism, and inflammation. On the other hand, free radicals originating from outside the body can be caused by exposure to cigarette smoke, motor vehicle emissions, solar radiation, consumption of fatty foods, coffee, and alcohol, use of medicinal oils, and exposure to toxic substances such as pesticides. In addition to these factors, stress and excessive physical activity can also increase the formation of free radicals. Unbeknownst to us, free radicals are continuously produced in the body through normal cellular metabolism, inflammatory processes, nutritional deficiencies, and responses to external factors such as environmental pollution, exposure to ultraviolet rays, and cigarette smoke. Furthermore, a polluted environment, an unbalanced diet, and an unhealthy lifestyle can stimulate an increase in the formation of free radicals, which have the potential to cause damage to the body (Rohmi Masitoh, A.M. Muslihin, 2022). Compounds that function to suppress or inhibit the activity of free radicals are called antioxidants (Rohmi Masitoh, A.M. Muslihin, 2022). The antioxidant activity of red fruit seeds is also supported by their carotenoid and vitamin E content, which act as effective free radical scavengers (Rumainum dan Tuhumena, 2019).

The extraction process is an important step in obtaining bioactive compounds from natural materials. The effectiveness of extraction is greatly influenced by the type of solvent, because the principle of "like dissolves like" determines the ability of a solvent to dissolve certain compounds based on their polarity (Hidayah et al., 2016). Solvents such as ethanol (polar), n-hexane (nonpolar), and ethyl acetate (semi-polar) are widely used to extract secondary metabolites from plants (Amin et al., 2024)).

The DPPH method is a simple, sensitive, and widely used technique for measuring antioxidant activity through the IC₅₀ parameter, which is the concentration required to inhibit 50% of free radicals (Arrofiqi et al., 2024). This measurement can be performed using UV-Visible spectrophotometry, which enables rapid and accurate analysis of compounds that absorb at specific wavelengths (Handoyo Sahumena et al., 2020).

Based on the above description, this study aims to assess the effect of different solvents, namely ethanol, n-hexane, and ethyl acetate, on the antioxidant activity of red fruit seed extract (*Pandanus conoideus Lam*) using the DPPH test method and UV-Visible spectrophotometry measurement.

2. Methods

Tools and materials

The equipment used in this study included aluminum foil, a blender, a stirring rod, porcelain bowls, funnels, measuring cups (Pyrex), filter paper, bowls, drying oven, test tube clamps, droppers, plastic wrap, test tube racks, test tubes, analytical scales (Ohaus), tissues, glass jars, water baths, and UV-Visible spectrophotometers. The materials needed for this research included distilled water, red fruit seed extract (*Pandanus conoideus Lam*), DPPH (1,1-diphenyl-2-picrylhydrazil), ethanol, ethyl acetate, and n-hexane, FeCl₃ reagent, Pb₂ acetate, Mayer reagent, Dragendroff reagent, and Bouchardat reagent

Process of Sample Extraction

A sample of red fruit seeds (*Pandanus conoideus Lam*) weighing 1.6 kg was cleaned of impurities, washed, separated from unusable parts, then drained and dried in an oven at 50 °C for three days (Purwaningsih et al., 2023). The dried seeds were ground using a blender until they became powder. A total of 100 g of seed powder was then extracted using the maceration method with 1 liter of solvent until the entire sample was submerged. The maceration process was carried out for 3×24 hours with periodic stirring, and the container was covered with aluminum foil to avoid exposure to light. The filtrate from the first filtration stage is then

stored, while the residue is re-macerated for 3 days using the same solvent. The filtrates from both stages are combined and evaporated at 50 °C using a water bath until a thick extract is obtained.

Phytochemical Screening Test

Flavonoid compounds

2 ml of red fruit seed extract (*Pandanus conoideus Lam*) is placed in a test tube, then 3 drops of Pb₂ acetate reagent are added. If flavonoids are present, a yellow color will form (Khafid et al., 2023).

Alkaloid compounds

A total of 2 ml of red fruit seed extract (*Pandanus conoideus Lam*) dripped with 2 drops of Mayer's reagent will show a positive result with the formation of a white precipitate. Meanwhile, the addition of 2 drops of Dragendorff's reagent to the filtrate will give a positive result, indicated by the formation of an orange-colored precipitate. Then, 2 drops of Bouchardat's reagent are added. Bouchardat's reagent produces a brown, reddish-brown to blackish-brown precipitate, indicating that the reagent contains alkaloids (Dewi dkk., 2021).

Saponin compounds

2 ml of test solution is placed in a test tube, then 10 ml of distilled water is added. The mixture is shaken vigorously for 10 minutes and left to stand for another 10 minutes. The appearance of foam that lasts for more than 10 minutes indicates the presence of saponin (Putri & Lubis, 2022).

Tanin compounds

A total of 2 ml of red fruit seed extract (*Pandanus conoideus Lam*) was then added to the FeCl₃ solution. The color change to blackish green indicated the presence of tannin compounds (Septia Ningsih et al., 2020).

Testing Antioxidant Activity with Ultraviolet-Visible Spectrophotometry

- a. Preparation of DPPH solution
To prepare a 0.4 mM DPPH solution, 0.0157 grams of DPPH powder was weighed and dissolved in ethanol to a volume of 100 ml in a measuring flask (Rika, 2024).
- b. Determination of wavelength
To prepare the blank solution, 1 ml of 0.4 mM DPPH solution is pipetted, then pure ethanol is added until the volume reaches 5 ml. This solution is stored for 30 minutes in a dark place, then the absorbance is measured in the wavelength range of 400 to 600 nm. The wavelength with the highest absorbance is determined as the maximum wavelength (Rika, 2024).
- c. Preparation of vitamin C reference solution
A 1000 ppm ascorbic acid stock solution was prepared by dissolving 10 mg of ascorbic acid in ethanol to a volume of 10 mL. The solution was then diluted to 100 ppm as a working solution. For antioxidant activity testing, 0.005–0.025 mL of the 100 ppm solution was pipetted into a 5 mL vial wrapped in aluminum foil. Each vial was added 1 mL of 0.4 mM DPPH solution and ethanol to reach the final volume, resulting in a concentration variation of 0.2–0.6 ppm. The samples were incubated for 30 minutes in the dark, then the absorbance was measured using a UV–Vis spectrophotometer at a wavelength of 519 nm (Rika, 2024).
- d. Free radical activity testing
A total of 10 mg of extract was weighed and dissolved in ethanol until homogeneous, then the volume was adjusted to 10 mL as a stock solution. The stock solution was then diluted to obtain five test concentrations, namely 2, 6, 8, 10, and 12 ppm by pipetting 0.01–0.06 mL of the stock solution

into a 5 mL volumetric flask and adding ethanol to the mark. Each 4 mL of test solution was mixed with 1 mL of 0.4 mM DPPH solution and incubated for 30 minutes in the dark. The absorbance of the test solution was then measured.

The mixture was then measured at a wavelength of 519 nm, and the value obtained was used to calculate the percentage of inhibition (Tunnazillah, 2024).

3. Result and Discussion

Result

The data from the red fruit seed extract is presented in the following table:

Simplisia	Pelarut (g)	Weight of crude drug (g)	Extract weight (g)	Yield (%)
Red fruit seeds	Ethanol 96%	100 gram	18 gram	18
	N-hexane	100 gram	11 gram	11
	Ethyl acetate	100 gram	12 gram	12

Tabel 4.1. Yield of red fruit seeds

Results of chemical screening of red fruit seeds (*Pandanus conoideus* Lam) with 96% ethanol, n-hexane, and ethyl acetate. Based on the results of phytochemical screening tests, ethanol extracts were found to contain flavonoids, alkaloids, tannins, and saponins. In the n-hexane extract, the detected compound was alkaloids, while the ethyl acetate extract showed the presence of alkaloids and saponins:

Tabel 4.2 phytochemical screening of red fruit seed extracts

Solvent	Compound group	Reagent	Observation Results	Description	
Ethanol	Flavonoid	Pb2 asetat	Yellow deposits formed	+	
	Alkaloid	Mayer	White or yellowish deposits form	-	
		Dragendorff	An orange-coloured deposit formed	+	
	Tanin	Bouchardat	Brown, reddish-brown to blackish-brown deposits formed	A blackish green deposit formed	+
					+
	Saponin	Aquades	Foam formation	+	
N-hexane	Flavonoid	Pb2 asetat	Yellow deposits formed	-	
	Alkaloid	Mayer	White or yellowish deposits form	+	
		Dragendorff	An orange-coloured deposit formed	-	
	Tanin	Bouchardat	Brown, reddish-brown to blackish-brown deposits formed	A blackish green deposit formed	+
					-
	Saponin	Aquades	Foam formation	-	
Ethyl acetate	Flavonoid	Pb2 asetat	Yellow deposits formed	-	
	Alkaloid	Mayer	White or yellowish deposits form	+	
		Dragendorff	An orange-coloured deposit formed	-	
	Tanin	Bouchardat	Brown, reddish-brown deposits formed	A blackish green deposit formed	+
					-
	Saponin	Aquades	Foam formation	+	

Ket : (+) contains compounds

(-) does not contain compounds

Tabel 4.3. Results of Antioxidant Activity Testing of Red Fruit Seed Ethanol Extract

No	Konsentrasi (ppm)	Persentase inhibisi (%)	Nilai IC50 (µg/mL)
1.	2	22,02	
2.	6	26,04	
3.	8	31,67	54,67 µg/mL
4.	10	21,7	
5.	12	29,58	

Tabel 4.4 Results of Antioxidant Activity Testing of Ethyl Acetate Extracts from Red Fruit Seeds

No	Konsentrasi (ppm)	Persentase inhibisi (%)	Nilai IC50 (µg/mL)
1.	2	44,21	
2.	6	45,17	
3.	8	48,87	19,92 µg/mL
4.	10	46,94	
5.	12	46,62	

Tabel 4.5 Results of Antioxidant Activity Testing of N-hexane Extracts from Red Fruit Seeds

No	Konsentrasi (ppm)	Persentase inhibisi (%)	Nilai IC50 (µg/mL)
1.	2	10,45	
2.	6	31,18	
3.	8	41,47	9,40 µg/mL
4.	10	61,25	
5.	12	60,12	

Tabel 4.6 Vitamin C Antioxidant Activity Test Results

No	Konsentrasi (ppm)	Persentase inhibisi (%)	Nilai IC50 (µg/mL)
1.	0,2	40,35	
2.	0,3	42,28	
3.	0,4	45,01	0,46 µg/mL
4.	0,5	50,80	
5.	0,6	57,39	

Discussion

Results of chemical screening of red fruit seeds (*Pandanus conoideus* Lam) with 96% ethanol, n-hexane, and ethyl acetate. Based on the results of phytochemical screening tests, ethanol extracts were found to contain flavonoids, alkaloids, tannins, and saponins. In the n-hexane extract, the detected compound was alkaloids, while the ethyl acetate extract showed the presence of alkaloids and saponins:

The red fruit used in this study consisted of 1.6 kg of fresh red fruit seeds harvested based on their red color. The samples were then wet sorted to remove impurities and other foreign materials. After that, the

samples were dried using an oven at a temperature of 50° until a final weight of 321 grams was obtained. This drying stage aimed to reduce the water content so that the samples would be more stable during storage and not easily damaged (Saputri & Sa'ad, 2023). Simplisia pollination is done to increase the contact surface area between the sample and the solvent, because smaller particle sizes allow for a more effective extraction process (Saputri & Sa'ad, 2023).

The solvents used in this study consisted of ethanol, n-hexane, and ethyl acetate with varying degrees of polarity. Ethanol was chosen because it is universal, polar, easily obtainable, and has high selectivity. In addition to being non-toxic, ethanol is also capable of extracting compounds with varying degrees of polarity, ranging from non-polar, semi-polar to polar (Vita Wendersteyt *et al.*, 2021). N-hexane solvent is used because it is effective in dissolving nonpolar compounds, is volatile, stable, and has good selectivity (Constanty & Tukiran, 2021). Meanwhile, ethyl acetate was chosen because it is semipolar, has low toxicity, is non-hygroscopic, and is volatile, making it suitable for extracting semipolar compounds (Kumala *et al.*, 2023). Each type of solvent was used to extract 100 grams of red fruit seeds (*Pandanus conoideus Lam*). The red fruit seed samples were extracted using the maceration method with several types of solvents. The resulting thick extract was reddish brown in color with the characteristic aroma of red fruit seeds. Extraction using ethanol yielded 18%, n-hexane yielded 11%, while ethyl acetate yielded 12%. The yield results from each solvent were considered good because the higher the yield value, the higher the content of substances extracted from the raw material. Results are categorized as good if they exceed 10%, so ethanol, n-hexane, and ethyl acetate solvents are included in the optimal results category. (Rahadyana *et al.*, 2024).

Phytochemical testing was conducted to identify the groups of secondary metabolites present in the extract of red fruit seeds (*Pandanus conoideus Lam*). In this study, the extraction process was carried out using three types of solvents with different polarities, namely ethanol (polar), n-hexane (nonpolar), and ethyl acetate (semipolar). Based on the test results presented in Table 4.2, the ethanol extract showed the presence of flavonoids, alkaloids, tannins, and saponins.

Testing flavonoids using Pb (II) acetate reagent produced positive results, indicated by the formation of a yellow precipitate. The precipitate formed because the hydroxyl group (-OH) on the benzene ring in the flavonoid structure reacted with the reagent, producing a yellow color as an indication of the presence of flavonoid compounds (Maulidie *et al.*, 2019). Alkaloid identification was performed using three types of reagents, namely Mayer, Dragendorff, and Bouchardat. The test results showed positive alkaloid reactions in the Dragendorff and Bouchardat reagents, marked by the formation of an orange-brown precipitate in the Dragendorff reagent and a brown precipitate in the Bouchardat reagent. Based on testing with 96% ethanol, a positive result was obtained for greenish-black tannin compounds. The color change to greenish-black occurred due to the formation of a complex between tannin and FeCl₃. The sample extract showed a positive result for the presence of catechin compounds in the sample (Yumita *et al.*, 2023).

n-Hexane extract only gave positive results for alkaloids in Mayer's and Bouchardat's reagents. The presence of brown precipitate in Mayer's reagent is due to the nitrogen atom in the alkaloid compound reacting with K⁺ tetraiodomercurate (II) ions, forming a potassium-alkaloid complex which then produces a brown precipitate (Elettaria & Maton, 2019). Meanwhile, the boucardat reagent produces a reddish-brown precipitate because the precipitate is formed due to a complex bond between potassium and alkaloids. The K⁺ ions contained in the alkaloid reagent interact with the free electron pair on the nitrogen atom, resulting in a bond between the free nitrogen electron and the K⁺ ion, which produces a precipitate (Hardiansyah *et al.*, 2024).

Ethyl acetate extract contains alkaloids and saponins. Alkaloids produce a reddish-brown precipitate in the Bouchardat reagent. The precipitate is formed due to the coordination covalent bond between K⁺ metal

ions and alkaloid compounds, resulting in the formation of an insoluble potassium-alkaloid complex. The Bouchardat reagent is known to contain potassium iodide and iodine (Indah Sulistyarini, 2019). Ethyl acetate extract contains positive saponins. This result is due to saponins being active compounds with high surface properties, enabling them to produce foam when shaken with water. The formation of foam in the saponin test occurs due to the presence of glycoside groups that can form foam in water and undergo hydrolysis into glucose and other compounds (Taufik, Haeruddin, 2023). These findings indicate that differences in solvent polarity play an important role in determining the types of compounds that can be extracted.

The antioxidant activity of red fruit seed extracts obtained with 96% ethanol, n-hexane, and ethyl acetate solvents, as well as a vitamin C reference solution, was analyzed using UV-Visible spectrophotometry. Vitamin C was used as a reference because red fruit is known to have a very high vitamin C content of 958.18 mg per 100 grams (Trisnawaty et al., 2024).

Antioxidant compounds function to neutralize free radicals through electron transfer mechanisms, thereby halting the chain reaction of free radical formation that has the potential to cause oxidative stress. Oxidative stress occurs as a result of an imbalance in redox reactions, namely when the number of free radicals exceeds the capacity of the antioxidant defense system (Sylviana et al., 2017).

DPPH is a stable purple synthetic free radical commonly used in the analysis of antioxidant activity through spectrophotometry. The DPPH method has several advantages, including a simple procedure that is easy to perform and requires minimal amounts of samples and reagents. Its principle of operation is based on the occurrence of a redox reaction between antioxidant compounds and DPPH radicals, where antioxidants act as hydrogen donors that neutralize DPPH. This reaction causes a color change in the solution from purple to yellow, accompanied by a decrease in absorbance values that can then be measured using UV-Visible spectrophotometry (Ngibad dan Puji, 2020).

In this study, the maximum wavelength obtained was 519 nm in the measurement range of 400–600 nm. Determination of the maximum wavelength of DPPH using UV-Visible spectrophotometry was performed to determine the highest absorption point of the DPPH solution (Tenda dkk., 2023). Determining this wavelength is necessary in creating a standard curve based on Lambert-Beer's law, which states that absorbance values are directly proportional to solution concentration and have a linear relationship with absorbance at a specific wavelength (Prasetyo dkk., 2021). In this study, absorbance measurements were performed at a wavelength of 519 nm.

Based on the results in Table 4.3, the absorbance of red fruit seed ethanol extract was measured at a wavelength of 519 nm with varying concentrations of 2, 6, 8, 10, and 12 ppm. The analysis showed an IC₅₀ value of 54.67 µg/mL, indicating that red fruit seed ethanol extract has strong antioxidant activity. Increasing the concentration of the extract resulted in a consistent increase in the percentage of inhibition, producing an IC₅₀ value that reflects high antioxidant capacity. Ethanol has a polarity level of 5.2, enabling it to attract more polar antioxidant compounds than the other two solvents. Meanwhile, based on the data in Table 4.4, ethyl acetate extract from red fruit seeds (*Pandanus conoideus* Lam) has an IC₅₀ value of 19.92 µg/mL, placing it in the category of very strong antioxidant activity. Ethyl acetate solvent, which is semi-polar, is effective in extracting certain antioxidant compounds. The IC₅₀ value describes the concentration of antioxidants needed to reduce 50% of DPPH free radicals; the smaller the IC₅₀ value, the higher the antioxidant activity. A compound is classified as very strong if it has an IC₅₀ < 50 ppm, strong if it is in the range of 50–100 ppm, moderate if it is in the range of 100–150 ppm, and weak if it is in the range of 151–200 ppm (Bahri dkk., 2025). Based on the data in Table 4.5, n-hexane extract from red fruit seeds showed an IC₅₀ value of 9.40 µg/mL, indicating very strong antioxidant activity. According to Hasanah et

al. (2023), n-hexane has a polarity value close to zero, making it non-polar and prone to extracting non-polar compounds that can also act as antioxidants. The IC₅₀ value was determined using a linear regression equation obtained from a series of sample concentration variations. Table 4.6 Based on the test results, the absorbance of the vitamin C solution was measured at a wavelength of 516 nm with concentration variations of 0.2 ppm, 0.3 ppm, 0.4 ppm, 0.5 ppm, and 0.6 ppm. Vitamin C showed an IC₅₀ value of 0.46 µg/mL, which indicates very strong antioxidant activity. Ascorbic acid or vitamin C has very strong antioxidant activity. This is due to the stable structure of ascorbic acid, which is able to donate two hydrogen atoms to DPPH free radicals and produce L-ascorbyl radicals, which are also stable (J.rohmah et al., 2020). Vitamin C acts as an antioxidant that helps prevent damage caused by free radicals. Vitamin C exhibits very strong antioxidant activity, as evidenced by an IC₅₀ value of less than 50 µg/mL. An increase in the concentration of the reference solution causes a decrease in the absorbance value and an increase in the percentage of antioxidant activity (Hardiansyah et al., 2024).

4. Conclusion

Solvent variation affects the phytochemical profile, yield, and antioxidant activity of red fruit seed extracts (*Pandanus conoideus Lam*). The 96% ethanol extract contained the most complete group of compounds, namely flavonoids, alkaloids, tannins, and saponins, while n-hexane and ethyl acetate extracts produced more limited compounds. The highest yield was obtained from the 18% ethanol extract, followed by n-hexane at 12% and ethyl acetate at 11%. Antioxidant activity testing using the DPPH method showed that all extracts had the ability to reduce free radicals, with the highest potential in n-hexane extract IC₅₀ 9.40 µg/mL, followed by ethyl acetate 19.92 µg/mL and 96% ethanol 54.67 µg/mL. These results indicate that nonpolar solvents provide the strongest antioxidant activity in red fruit seed extracts. Hopefully someone can continue this research, not only using solvent variations but also using the FTIR tool.

5. Reference

- Amin, A., Waris, R., Yuliana, D., & Fitri, N. (2024). Hubungan Kemampuan Aktivitas Antioksidan dengan Pelarut Ekstraksi Daun Pecut Kuda (*Stachytarpheta jamaicensis L.*). *Of Pharmaceutical and Health Research*, 5(3), 33–41. <https://doi.org/10.47065/jharma.v5i3.5221>
- Arrofiqi, M. R., Sakti, A. S., Dita, F., Farmasi, P. S., Kesehatan, F. I., Muhammadiyah, U., Kesehatan, F. I., Lamongan, U. M., Farmasi, D. T., Kesehatan, F. I., & Lamongam, M. (2024). kajian literatur: aplikasi sejumlah metode ekstraksi konvensional untuk mengekstraksi senyawa fenolik dari bahan alam. *Farmasi Dan Herbal*, 7(1).
- Bahri, S., Setiadi, D., Lestari, T. A., Setiawan, H., Hakim, A., & Cahyadi, L. M. Z. (2025). Jurnal Biologi Tropis The Comparison of IC 50 of Suji (*Pleomele angustifolia*) which is Extracted by Different Solvent. *Jurnal Biologi Tropis*.
- Constanty, I. C., & Tukiran, T. (2021). aktivitas antioksidan dari fraksi N-heksana kulit batang tumbuhan jambu semarang (*Syzygium samarangense*). *Jurnal Kimia Riset*, 6(1), 1. <https://doi.org/10.20473/jkr.v6i1.24467>
- Elettaria, L., & Maton, L. (2019). Uji Aktivitas Antioksidan Ekstrak Etanol Fraksi Heksan, Fraksi Etil Asetat dan Fraksi Air Daun Kapulaga (*Elettaria cardamomum (L.) Maton*). *Jurnal of Pharmaceutical and Sciences*, 2(1), 30–37.
- Handoyo Sahumena, M., Ruslin, R., Asriyanti, A., & Nurrohwinata Djuwarno, E. (2020). Identifikasi Jamu Yang Beredar Di Kota Kendari Menggunakan Metode Spektrofotometri Uv-Vis. *Journal Syifa Sciences and Clinical Research*, 2(2), 65–72. <https://doi.org/10.37311/jsscr.v2i2.6977>
- Hardiansyah, L. O., Muslihin, A. M., & Astuti, R. A. (2024). studi in vitro ekstrak kulit batang tali kuning (a . The Effect of Solvent Variation on Antioxidant Activity in Red Fruit Extract (*Pandanus Conoideus Lam*) Using UV-Visible Spectrophotometry. Liwen Vinesia Bilat Werluka et al

- cocculus*) sebagai antioksidan. *Jurnal Kesehatan Tambusai*, 5, 12785–12792.
- Hidayah, N., Hisan, A. K., Solikin, A., Irawati, I., & Mustikaningtyas, D. (2016). Uji Efektivitas Ekstrak *Sargassum muticum* Sebagai Alternatif Obat Bisul Akibat Aktivitas *Staphylococcus aureus*. *Journal of Creativity Student*, 1(2). <https://doi.org/10.15294/jcs.v1i2.7794>
- Indah Sulistyarini*, D. A. S. dan T. A. W. (2019). Skrining Fitokimia Senyawa Metabolit Sekunder Batang Buah Naga... (Sulistyarini, dkk). *Jurnal Ilmiah Cendekia Eksakta*, 56–62.
- J.rohmah, H., Putih, T., Dengan, L. P., Ramadhani, D. N., & Wulandari, H. P. (2020). aktivitas antioksidan ekstrak etanol, etil asetat, dan N- heksana batang turi putih (*Sesbania grandiflora (L.) Pers.*) dengan metode DPPH (1,1-Diphenyl-2-picrylhydrazyl). *Jurnal Kimia Riset*, 5(1), 67–85.
- Khafid, A., Wiraputra, M. D., Putra, A. C., Khoirunnisa, N., Putri, A. A. K., Suedy, S. W. A., & Nurchayati, Y. (2023). Uji Kualitatif Metabolit Sekunder pada Beberapa Tanaman yang Berkhasiat sebagai Obat Tradisional. *Buletin Anatomi Dan Fisiologi*, 8(1), 61–70. <https://doi.org/10.14710/baf.8.1.2023.61-70>
- Khairani, A. C., & Indriani, N. (2024). Identifikasi Kandungan Senyawa Fitokimia Minyak Buah Merah (*Pandanus conoideus Lam .*) Identification Of Phytochemical Compound Content of Red Fruit Oil (*Pandanus conoideus Lam .*). *Jurnal Kolaboratif Sains*, 7(12), 4599–4603. <https://doi.org/10.56338/jks.v7i12.6335>
- Kumala, R. C. R., Nuri, & Fauziah, D. T. (2023). uji aktivitas antibakteri lidah buaya (*aLOE VERA*) terhadap pertumbuhan bakteri propionibacterium acnes antibacterial activity test of aloe vera (*Aloe vera*) on the growth of bacteria Propionibacterium acnes. *Journal of Medical Laboratory in Infectious and Degenerative Diseases*, 1(1), 1–8.
- Maulidie, M., Saputera, A., Widia, T., Marpaung, A., & Ayuchecaria, N. (2019). konsentrasi hambat minimum (khm) kadar ekstrak etanol batang bajakah tampala (*Spatholobus littoralis Hassk*) terhadap bakteri escherichia coli melalui. *Jurnal Ilmiah Manuntung*, 5(2), 167–173.
- Ngibad, K., & Puji, L. (2020). Aktivitas Antioksidan dan Kandungan Fenolik Total Daun Zodia (*Evodia suaveolens*). *ALCHEMY Jurnal Penelitian Kimia*, 16(1), 94–109. <https://doi.org/10.20961/alchymy.16.1.35580.94-109>
- Nugroho, A. W. (2017). Review: Konservasi Keanekaragaman Hayati Melalui Tanaman Obat Dalam Hutan Di Indonesia Dengan Teknologi Farmasi: Potensi dan Tantangan. *Jurnal Sains Dan Kesehatan*, 1(7), 377–383. <https://doi.org/10.25026/jsk.v1i7.71>
- Parlindungan, N., & Sugito, K. (2018). Aktivitas Antioksidan Fraksi Metanol Daun Jeringau Merah (*Acorus Sp.*) Metode DPPH. *Jurnal Laboratorium Khatulistiwa*, 2(1), 26–29.
- Prasetyo, E., Zukhruf, N., Kharomah, W., & Rahayu, T. P. (2021). Ekstrak Etanol Kulit Buah Durian (*Durio zibethinnus L .*) dari Desa Alasmalang Kabupaten Banyumas. *Jurnal Pharmascience*, 08(01), 75–82.
- Purwaningsih, D., Ar, M. A., Marwati, D., Farmakologi, B., Klinik, F., Farmasi, S., Tinggi, S., Farmasi, I., Farmasi, B. B., Farmasi Makassar, I., & Kunci, K. (2023). SKRINING antikanker ekstrak buah merah (*pandanus conoideus L.*) dengan variasi cairan penyari menggunakan metode bslt (Brine Shrimp Letality Test). *Majalah Farmasi Dan Farmakologi*, 27(2), 39–42. <https://doi.org/10.20956/mff.v27i2.24537>
- Putri, D. M., & Lubis, S. S. (2022). skrining fitokimia ekstrak etil asetat daun kalayu (*Erioglossum rubiginosum (Roxb.) Blum*). *Amina*, 2(3), 120–125. <https://doi.org/10.22373/amina.v2i3.1384>
- Rahadyana, R. Z., Artini, K. S., & Wardani, T. S. (2024). Uji Aktivitas Antioksidan Ekstrak Biji Bunga Matahari (*Helianthus Annuus L*) Dengan Menggunakan Metode. *Jurnal Kesehatan Tambusai*, 5(September), 8049–8056.
- Rika, E. (2024). Uji Aktivitas Antioksidan Fraksi Ekstrak Etanol Tali Kuning (*Anamirta cocculus*) Dengan Metode DPPH Antioxidant Activity Test of Fraction Extract Ethanol Tali Kuning (*Anamirta cocculus*). *Skrripsi Universitas Pendidikan Muhammadiyah Sorong*, 7(2), 381–391.
- The Effect of Solvent Variation on Antioxidant Activity in Red Fruit Extract (*Pandanus Conoideus Lam*) Using UV-Visible Spectrophotometry. Liwen Vinesia Bilat Werluka et.al

<http://journal.unpacti.ac.id/index.php/JPP>

- Rohmi Masitoh¹, A.M. Muslihin², A. B. B. (2022). uji aktivitas antioksidan ekstrak etanol tali kuning (*Anamirta Cocculus*) Rohmi. *Jurnal Kesehatan STIKes Buleleng*, x(maret), 10.
- Rumainum, I. M., & Tuhumena, V. (2019). Potensi Antioksidan Pada Buah Lokal Papua. *Jurnal Teknologi Hasil Pertanian*, IX(1), 31–40. <https://doi.org/10.35724/mjar.v1i1.1714>
- Saputri, A. D. S., & Sa'ad, M. (2023). penetapan kadar fenolik dan flavonoid fraksi daun insulin (*Smalanthus sonchifolius*) secara spektrofotometri uv-vlS. *Jurnal Farmasi Medica/Pharmacy Medical Journal (PMJ)*, 6(1), 51–58. <https://doi.org/10.35799/pmj.v6i1.48197>
- Septia Ningsih, D., Henri, H., Roanisca, O., & Gus Mahardika, R. (2020). Skrining Fitokimia dan Penetapan Kandungan Total Fenolik Ekstrak Daun Tumbuhan Sapu-Sapu (*Baekkea frutescens L.*). *Biotropika: Journal of Tropical Biology*, 8(3), 178–185. <https://doi.org/10.21776/ub.biotropika.2020.008.03.06>
- Study, U., Village, C. B., District, A. K., Sumatra, S., Aisyah, I., Rohmah, N., & Amalia, I. D. (2024). Studi Pemanfaatan dan Peran Masyarakat Lokal terhadap Konservasi Tumbuhan Obat di Desa Cintamanis Baru, Kecamatan Air Kumbang, Banyuasin Sumatera Selatan. *Penerbit Universitas Sriwijaya (UNSRI)*, 6051, 490–500.
- Sylviana, N., Gunawan, H., Lesmana, R., Purba, A., & Akbar, I. B. (2017). Efek Astaxanthin dan Latihan Teratur terhadap Pola Stres Oksidatif Pria Setelah Aktivitas Berat The Effect of Astaxanthin and Regular Training on Dynamic Pattern of Oxidative Stress on Male under Strenuous Exercise. *Jurnal Farmasi Klinik Indonesia*, 6(1). <https://doi.org/10.15416/ijcp.2017.6.1.46>
- Taufik, Haeruddin, N. (2023). Uji Aktivitas Antioksidan Fraksi n-Heksan dan Etil Asetat Daun Kelor (*Moringa oleifera*). *Jurnal Kimia Dan Pendidikan Kimia*, 12(2012).
- Tenda, P. E., Kapitan, L. A. V., Indrawati, M. I. M., & Soeharto, F. R. (2023). Kajian kualitas dan aktivitas antioksidan sediaan sirup ekstrak faloak (*Sterculia quardifida R.Br.*) dengan variasi penambahan jahe (*Zingiber officinale R.*). *Jurnal Ilmiah Farmasi*, 19(1), 15–30.
- Trisnawaty, S. R. I., Gunadi, J. W., Ratnawati, H., Maranatha, P. B., Histologi, D., Kedokteran, F., Maranatha, U. K., Barat, J., Fisiologi, D., & Biomedis, D. I. (2024). Karotenoid dalam buah merah (*Pandanus conoideusLam.*) memiliki peran potensial sebagai agen anti-pigmentasi (Ulasan). *Jurnal spandidos publications*, 1–11. <https://doi.org/10.3892/br.2024.1742>
- Tunnazillah, N. (2024). uji aktivitas antioksidan ekstrak etanol tangkai pinang (*Areca catechu L.*) dengan menggunakan metode DPPH (2,2 difenil-1-pikrilhidrazil). Universitas Pendidikan Muhammadiyah Sorong.
- Vita Wendersteyt, N., Wewengkang, D. S., & Sumantri Abdullah, S. (2021). uji aktivitas antimikroba dari ekstrak dan fraksi ascidian *Herdmania momus* dari perairan pulau bangka likupang terhadap pertumbuhan mikroba *Staphylococcus aureus*, *Salmonella typhimurium* DAN *Candida albicans* Novira. *Pharmacon*, 10(1), 706–712.
- Yumita, A., Putu, N., Hikmawanti, E., Andini, R. F., & Nurwiati, I. (2023). penetapan kadar fenolik total dan kadar tanin total ekstrak etanol 96 % daun wijaya kusuma (*Epiphyllum oxypetalum (DC.) Haw.*) dengan metode spektrofotometri. *Jurnal Wiyata*, 10, 98–108.