

Phytochemical Analysis and Antioxidant Activity Test of Bayur Medicinal Plants (*Pterospermum javanicum*)

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Received: May 10, 2023

Revised: June 30, 2023

Accepted: July 25, 2023

Published: July 31, 2023

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DOI: [10.29303/jppipa.v9i7.3833](https://doi.org/10.29303/jppipa.v9i7.3833)

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Abstract: Bayur (*Pterospermum javanicum*) is a plant species from the Malvaceae family which is a medicinal plant that is often found in Indonesia, especially in the forests of Central Sulawesi. Bayur leaf extract is used as an external medicine, namely to treat back pain, sprains, gout, scabies, cysts, itching, peeling skin and festering wounds. As an internal medicine, namely to treat diarrhea, gastrointestinal disorders, respiratory disorders, lowering high blood pressure, insomnia, blood urine and as a cosmetic. This study aims to screen phytochemicals and analyze the antioxidant activity of bayur medicinal plants. The method used for the phytochemical test is a qualitative method by observing the change in color and shape of the liquid after testing. The DPPH method was used to determine its antioxidant activity. The results showed that bayur leaf extract contained alkaloids, flavonoids, tannins, steroids and terpenoids, while bayur bark positively contained alkaloids, flavonoids, tannins and terpenoids. The results of the antioxidant activity test of bayur leaf and bark extracts using the DPPH method, bayur leaves have an IC₅₀ of 62.438 ppm and bayur bark has an IC₅₀ of 75.878 ppm. The antioxidant activity of bayur leaves and skin is in the strong category.

Keywords: Antioxidant; medicinal plant; phytochemical analysis; *Pterospermum javanicum*.

Introduction

Indonesia is one of the countries with the second largest tropical forest in the world after Brazil with a forest area of 120.7 million ha (Ango et al., 2020). A forest is an ecosystem unit in the form of a stretch of land containing biological natural resources dominated by trees in their natural environment, which cannot be separated from one another (Kumar & Garkoti, 2021). Forests in Indonesia have many benefits for the Indonesian economy (Sahide et al., 2016). Both direct and indirect benefits (Duffy et al., 2021). Direct benefits such as forest products (Pendriell et al., 2019).

Forest products are divided into two types, namely timber forest products and non-timber forest products (Pendriell et al., 2019). Non-timber forest products are biological forest products, both vegetable and animal,

along with their derivative and cultivated products, except for wood originating from forests (de Mello et al., 2020). In general, non-timber forest products are byproducts of a tree, for example sap, leaves, bark, fruit and others or in the form of plants that have special characteristics such as rattan, bamboo and others (Suleiman et al., 2017). Broadly speaking, the potential for non-timber forest products is divided into several types. Such as resins, essential oils, fatty oils, carbohydrates, fruits, latex and tannins, bamboo, rattan, animal products, forest services, ornamental and medicinal plants and so on (de Mello et al., 2020).

Of the several types of non-timber forest products, one of which is often used is medicinal plants (Hapid et al., 2021a). Indonesia is a country that is rich in various biodiversity that has the potential to be developed as medicinal plants (Hapid & Ramlah, 2016). Communities

How to Cite:

Hapid, A. (2023). Phytochemical Analysis and Antioxidant Activity Test of Bayur Medicinal Plants (*Pterospermum javanicum*). *Jurnal Penelitian Pendidikan IPA*, 9(7), 5509–5515. <https://doi.org/10.29303/jppipa.v9i7.3833>

use medicinal plants as an alternative treatment, both for prevention (preventive), healing (curative), health restoration (rehabilitative) and health promotion (promotive) (Maruca et al., 2019; Tugume et al., 2016).

Traditional medicine using medicinal plants is not foreign to Indonesian society, because traditional medicine is still recognized by the wider community (Hapid, Napitupulu, & Zubair, 2021b). Some of the advantages of using traditional medicinal plants include being relatively safer, easy to obtain, easy to obtain, inexpensive, do not cause resistance, and are relatively harmless to the surrounding environment (Alsarhan et al., 2012; Güneş et al., 2017). One of the medicinal plants used by local people in rural areas of Central Sulawesi is bayur (*Pterospermum javanicum*).

Bayur (*Pterospermum javanicum*) is a plant species from the Malvaceae family. This plant is a type of tree that produces good quality carpentry wood. A tree commonly found in the lowlands. So far, people only know the bayur plant as a carpentry tree and grows in forest areas. The benefits of bayur leaf extract are as follows; as an external drug, namely to treat lumbago, sprains, tendonitis, scabies, cysts, itching, peeling skin and festering wounds. As an internal medicine, namely to treat stomach aches, disorders of the digestive tract, respiratory disorders, lowering high blood pressure, and as a cosmetic. Currently, studies on phytochemical and antioxidant analysis of bayur medicinal plants, especially those grown in the Central Sulawesi region, have not been widely reported by researchers. The purpose of this study was to perform phytochemical screening and analysis of the antioxidant activity of bayur medicinal plants.

Method

Place of Research

This research will be carried out at the Research Laboratory of the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Tadulako University.

Materials and tools

The materials used in this research were leaves and bark of bayur (*Pterospermum javanicum*) aged \pm 20 years from Sigi Regency, Central Sulawesi, 96% ethanol solvent and N-Hexane solvent, Aluminum Foil, Aquades, Whatman 42 Filter Paper, H₂SO₄, Meyer's reagent, Dragendroff's reagent, Chloroform, Acetic Anhydride, FeCl₃, HCL 2 N, NaOH, Magnesium Powder, DPPH (2,2-diphenyl-1-pikrihidrazyl).

The tools used in this study were scales, measuring cups, blenders, Erlenmeyer, measuring flasks, spatulas, beakers, funnels, rotary evaporators, analytical balances,

pipettes, test tubes, stirring rods, UV spectrophotometers.

Research methods

This research method is divided into several stages, namely as follows:

Manufacture of Bayur Leaf and Bark Powder

Bayur leaves and skin that have been collected are cleaned using running water to remove adhering dirt. Once clean, the leaves and skin of the bayur are dried in the oven until completely dry and brittle. After drying, the leaves and skin of the bayur are crushed using a blender and then the powder is sieved (Hapid et al., 2021b).

Maceration

Bayur leaves and skin that have become powder are then extracted by maceration. Samples were immersed in 96% ethanol solvent. With a measure of 1:5 for 24 hours with stirring. After that it was filtered to get the filtrate. The filtrate obtained was then re-macerated again with 96% ethanol. After that the filtrate obtained was evaporated to obtain ethanol extract (Oladeji et al., 2020).

Phytochemical Test of Bayur Leaves and Bark

Alkaloid test

As much as 1 ml of bayur leaf and bark extract is put into a test tube and 2-3 drops of reagent are added. The sample extract tested positive for alkaloids when it produced an orange precipitate (Hapid et al., 2021b).

Flavanoid test

The flavanoid test was carried out by inserting 1 ml of sample solution into a test tube and then adding magnesium powder and a few drops of concentrated HCl (shinoda reagent). If the resulting solution is orange, pink, or red, then the positive solution contains flavonoids (Hapid et al., 2021b).

Terpenoid Test

As much as 1 ml of bayur leaf extract mixed with 0.5 chloroform. Then 1.5 ml was concentrated to form a layer, then added H₂SO₄. The presence of terpenoids is indicated by the formation of a reddish brown solution on the surface (Hapid et al., 2021b).

Tannin Test

As much as 1 ml of sample solution was put into a test tube and then added a few drops of 5% FeCl₃. The presence of tannins is indicated by the formation of a green-brown or blue-black solution (Hapid et al., 2021b).

Saponin Test

A total of 1 ml of sample solution was put into a test tube then added distilled water and then shaken for 15 minutes. If it has foam or is as high as 1 cm in 5 minutes, the sample solution is positive for saponins (Hapid et al., 2021b).

Steroid Test

As much as 1 ml of the extract was dissolved in 5 ml of chloroform and then added 6 ml of concentrated sulfuric acid on the side of the tube. If the top layer is red and the bottom layer of sulfuric acid shows yellow and green, it indicates the presence of steroids (Hapid et al., 2021b).

Carotenoid Test

As much as 1 ml of the extract was mixed with 5 ml of chloroform in a test tube, then shaken and then filtered and then added 85% sulfuric acid. If a blue color is formed on the surface it indicates the presence of carotenoids (Hapid et al., 2021b).

Antioxidant Activity Test

Concentrated extracts of bayur leaves and bark were determined for antioxidant activity using UV spectrometer method with DPPH reagent. The sample extract was weighed as much as 10 mg and then put into a 10 ml volumetric flask. Then determined with ethanol solvent to obtain a solution concentration of 1000 ppm. Then serial dilutions were carried out to obtain solutions of 20, 40, 60, 80 and 100 ppm. Pipette 1 ml of the solution that has been made and add 3 ml of 50M DPPH solution. The mixture was homogenized and left for 30 minutes in a dark place. Then the absorption was measured at a wavelength of 517 nm. Tests were also carried out on DPPH solutions. The absorbance value that has been obtained is used to determine the % inhibition using the following equation (Hapid et al., 2021a):

$$\%inhibisi = \frac{Abs\ DPPH + Abs\ Sample}{Abs\ DPPH} \times 100\% \quad (1)$$

Data analysis

The data obtained is presented descriptively by looking at the color change and the shape of the liquid being tested. The data obtained from the phytochemical tests of bayur leaf and bark extracts are presented in the form of figures and tables. The data obtained from the antioxidant activity test of bayur leaves and bark were analyzed using the regression equation (Hapid et al., 2021a).

Result and Discussion

Phytochemical Test Results of Bayur Leaves and Bark

Table 1. Results of phytochemical analysis of bayur leaves and bark.

Compound	Phytochemical Test Results	
	Leaf	Skin
Alkaloids	+	+
Tannins	+	+
Flavanoids	+	+
Saponins	-	-
Steroids	+	-
Terpenoids	+	+
Carotenoids	-	-

Information:

+ :Positive (Contains compounds/color forms)

- : negative (does not contain compounds / does not form color)

Alkaloid Test

Testing of bayur leaf and bark extract compounds using ethanol solvents showed positive results containing alkaloids. Alkaloid compounds have benefits in the health sector including functioning as analgesics, changing the work of the heart, affecting blood circulation and respiration, uterine stimulants, antimalarials, and local anesthetics (Alsadig et al., 2020). In the food sector, alkaloids are not widely used, but in the field of pharmacology, they are widely used, among others, to accelerate wound healing, nervous system stimulants, malaria drugs, cough medicines and anti-bacterials (Hapid et al., 2021a). Alkaloids have an effect in the form of anti-diabetes mellitus, anti-hypertension (Street et al., 2017).

Tannin Test

Tests for the content of tannin compounds from bayur leaf and skin extracts showed positive results. This is due to the presence of tannin compounds which are characterized by the formation of changes to a brownish green or blackish blue color. In the health sector, condensed tannins have activity as antioxidants and can protect the skin from damage caused by ultraviolet radiation (Javed et al., 2020). Tannin compounds in some plants can also act as anti-diarrhea and anti-inflammatory (Shinde & Mulay, 2015).

Flavanoid Test

Tests for the content of flavanoid compounds from bayur leaf extract and bark showed positive results. This is due to the occurrence of an orange discoloration on the leaves while on the skin there is a red discoloration. Flavonoid compounds are a class of polyphenolic compounds which are known to have properties as free radical scavengers, inhibitors of hydrolytic and oxidative enzymes and work as anti-inflammatories

(Muller, 2018). Flavanoid compounds are also useful for increasing the effectiveness of vitamin C, protecting cell structures, preventing bone loss and as antibiotics (Nugraha et al., 2017).

Saponin Test

Testing for the content of saponin compounds from bayur leaf and skin extracts showed negative results because there was no foam or froth on the leaves and skin after shaking. Saponins are natural surfactants, and will form foam when shaken vigorously (Alsadig et al., 2020). Saponins can be found in the roots, bark, leaves, seeds and fruit and function as a self-defense system (Bhatla, 2018). Saponins have activity as anti-microbial, anti-fungal, anti-inflammatory so that they can cure diarrhea, dysentery, canker sores, leucorrhoea, and ulcers (Puspita et al., 2018; Wafa et al., 2016).

Test Steroids

Testing for the content of steroid compounds from bayur leaf extract positively contained steroids, while bayur peel extract did not contain steroid compounds, this was indicated by the absence of a change in the color of the solution to yellow and green. Steroid compounds have an important role for the body in controlling metabolism, maintaining salt balance and improving the function of sexual organs. Steroid compounds can be used as a source of antibacterial and anti-inflammatory (Hapid et al., 2021b). Steroid compounds are also used to treat dangerous diseases such as arthritis, allergies and diseases caused by fatigue or hormone deficiencies (Doğan et al., 2017).

Terpenoid Test

Tests for the content of terpenoid compounds from bayur leaf extract and bark showed positive results. This is indicated by a change in the color of the solution to a reddish-brown color on the surface (Hapid et al., 2021a). In several types of medicinal plants, terpenoid compounds function as antibacterials, cancer cell inhibitors, inhibition of cholesterol synthesis, anti-inflammatory, menstrual disorders, malaria, snake bites and skin disorders (Zubair et al., 2021). In plants, terpenoid compounds work as antimicrobials, insecticides, antifungals, and stimulate insects to lay eggs (Wang, 2019).

Carotenoid Test

The test for carotenoid compounds was carried out by adding chloroform and then adding 85% sulfuric acid. The solution is said to be positive for carotenoids when a blue color is formed on the surface. The results of the negative bayur leaf and skin extract test did not contain carotenoid compounds because there was no change in the shape of the color to blue on the surface.

Carotenoids are compounds that are abundant in vegetables and fruits and have anti-cancer effects (Naeem et al., 2016). The main function of carotenoids in plants is to provide red and yellow pigments for photosynthesis. Broadly speaking, carotenoids have benefits as antioxidants that can protect cells from damage caused by free radicals that can trigger cancer (Kusuma et al., 2014).

Antioxidant Activity Test Results of Bayur Leaves and Bark (Pterospermum javanicum)

Table 2. Antioxidant Activity Test Results of Bayur Leaf Extract

Extract Concentration (ppm)	Abs 517 nm	% Inhibisi	DPPH	IC50
20	0.255	39.652		
40	0.235	44.392		
60	0.212	49.684	0.422	62.438
80	0.191	54.818		
100	0.174	58.689		

Table 3. Antioxidant Activity Test Results of Bayur Bark Extract

Extract Concentration (ppm)	Abs 517 nm	% Inhibisi	DPPH	IC50
20	0.276	34.597		
40	0.254	39.889		
60	0.230	45.577	0.442	75.878
80	0.207	50.948		
100	0.181	57.030		

The following is the regression equation curve for % inhibition on the concentration of ethanol extract of bayur leaves and bark, which can be seen in Figures 1 and 2.

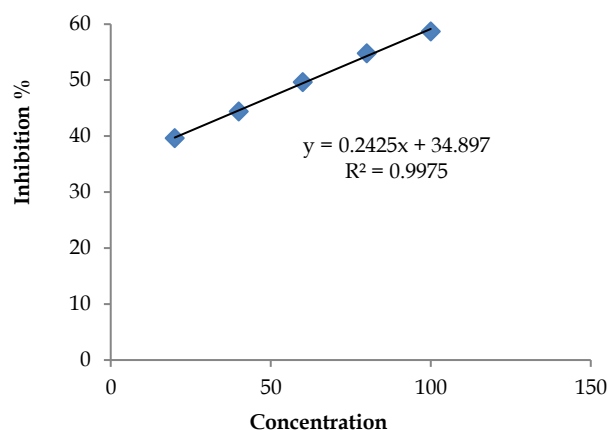


Figure 1. Regression Analysis Curve of % Inhibition on the Concentration of Bayur Leaf Ethanol Extract

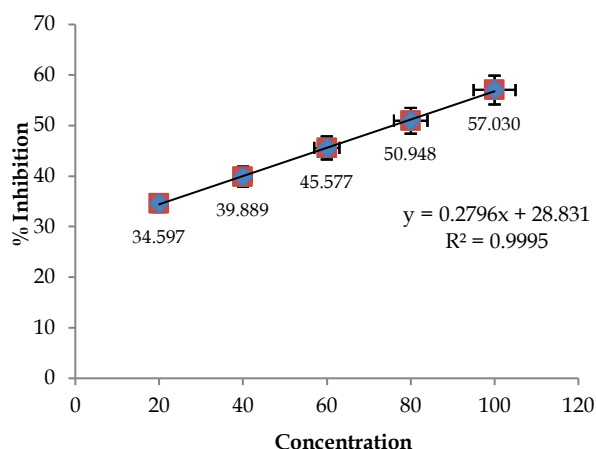


Figure 2. Regression Analysis Curve of % Inhibition on the Concentration of Bayur Skin Ethanol Extract

Based on the results of testing the antioxidant activity of bayur leaves and bark in tables 2 and 3, of the five concentrations at a wavelength of 517 nm it shows that the concentration changes in absorbance, the higher the concentration of the test solution, the lower the absorbance value, this can be interpreted that DPPH acts as a free radical. Free radicals have been soaked by the antioxidants present in the test sample solution.

Based on the IC₅₀ (inhibition concentration) value obtained from the antioxidant activity test of bayur leaf and bark extracts using 96% ethanol solvent of 62.438 ppm in bayur leaves, while in bayur bark it is 75.878 ppm and is included in the strong category. The ability of the antioxidant activity of the ethanol extract of bayur leaves and bark in inhibiting free radicals is said to be strong because it has a low IC₅₀ value. The smaller the concentration of the IC₅₀ value indicates that the antioxidant activity in the test sample is greater. The smaller the IC₅₀ value, the stronger the antioxidant activity. Specifically, a compound is said to be a very strong antioxidant if the IC₅₀ value is <50 ppm, strong is 50-100 ppm, moderate is 100-150 ppm, weak is 150-200 ppm, very weak if IC₅₀ is >200 ppm (Molyneux, 2004).

The content of secondary metabolites contained in the ethanol extract of bayur leaves and bark has strong antioxidant activity. Based on the phytochemical tests that have been carried out, the compounds contained in the ethanol extract of bayur leaves are alkaloids, tannins, flavanoids, steroids and terpenoids. Meanwhile, the ethanol extract of bayur bark contains alkaloids, tannins, flavonoids and terpenoids. The results of research on several plants that have potential as antioxidants generally contain flavanoid, tannin and steroid compounds and other antioxidant-rich secondary metabolites such as polyphenols, saponins, and carotenoids. Differences in antioxidant activity are

usually related to the content of phenolic/flavonoid compounds. Phenol and flavonoid compounds have a linear contribution to antioxidant activity, so the higher the levels, the better the antioxidants (Ghasemzadeh & Ghasemzadeh, 2011; Zuraida et al., 2017). For this study using bayur plant extract, the high antioxidant activity was influenced by the content of flavonoids and terpenoid compounds. Because bayur leaf and skin extracts contain these two compounds. The results of several studies show that the antioxidant activity of plant extracts is also influenced by other phenolic components such as tannins which are known to have antioxidant activity (Ghasemzadeh & Ghasemzadeh, 2011).

Conclusion

The results of the phytochemical test analysis of bayur leaf and bark extract (*Pterospermum javanicum*.) using 96% ethanol solvent were positive for alkaloids, tannins, terpenoids, steroids and flavanoids. The results of the antioxidant activity test of bayur leaf extract had an IC₅₀ value of 62.438 while bayur bark had an IC₅₀ value of 75.878. The results showed that the antioxidant activity of bayur leaf and bark extract (*Pterospermum javanicum*.) using 96% ethanol solvent was strong. Bayur bark and wood extract has the potential to be used as a natural antioxidant.

Acknowledgments

The author would like to thank Zulkaidah and Hamka for helping to take research samples.

Author Contributions

This article is the result of independent research conducted by Abdul Hapid. research design, methodology and article preparation were carried out by Abdul Hapid.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

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