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Antioxidant Activity of Bay (*Syzygium polyanthum [Wight] Walp)* Leaf Extract Toner

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Abstract

Facial skin susceptible to oxidative stress due to free radicals can be prevented by increasing the amount of antioxidants. Bay leaf extract is known to have antioxidant activity, it can be formulated into a toner. The purpose of this study was to determine the physical quality and antioxidant activity of bay leaf extract toner. The method used was experimental, with four formulas of variations in the concentration of bay leaf extract addition, namely F0 (0%), F1 (1.5%), F2 (3%), and F3 (6%). The extract was obtained through maceration using 96% ethanol, and then tested for physical quality consisting of organoleptic, pH and viscosity, and antioxidant activity with the DPPH method. The results showed an extract yield of 12.58%. The best formula for bay leaf extract toner preparation was F2, with physical quality including liquid organoleptic, light brown color, the distinctive odor of bay leaf extract; pH 4.74; viscosity 3.81 cP; and IC_{50} of 46,090 ppm with a very strong antioxidant activity category. Conclusion, bay leaf extract has the potential to be a natural active ingredient in skin care products that is effective in protecting the skin from the effects of free radicals.

Keywords: antioxidant; bay leaf; Syzygium polyanthum; toner

Introduction

Facial skin is the outermost organ that is very susceptible to oxidative stress due to free radicals that can accelerate premature aging. Research results state that premature aging has occurred in men and women under the age of thirty (Manríquez et al., 2014). Several things cause premature aging, including UV rays, pollution, free radicals, and DNA damage (Aizah, 2016), (Prakoeswa & Sari, 2022). Free radicals are one of the factors causing skin damage (A. Wahyuni et al., 2024). Free radicals are molecules that have a group of atoms or unpaired electrons with high reactivity characteristics (Irianti, T et al., 2021), When they enter the body, they easily react with compounds in the body so that they will form new free radicals in the body (Tambunan et

al., 2024). As a result, if it is continuously in the body, especially the face, it will cause wrinkled skin, black spots, a dull face, rough, dry skin, and aging (Andarina & Djauhari, 2017).

Efforts are needed to protect the body from the effects of free radicals, namely by increasing the amount of antioxidants (Haerani et al., 2018). Antioxidants are compounds that can absorb and neutralize free radicals (Irianti, T et al., 2021). Sources of antioxidants can be synthetic, obtained from chemical reactions, or natural, obtained from plants (Jamilatun, 2023), (Jamilatun & Lukito, 2025) (Makhabbah Jamilatun et al., 2025). One plant that is known to have high antioxidant activity is the bay plant (*Syzygium polyanthum* (Wight) Walp). This plant is not only used as a cooking spice but also has the potential to be an antioxidant that can reduce the formation of free radicals (Aklimah & Ekayanti, 2022). The part of the bay plant used is the leaves (Bhadreswara & Susanti, 2023).

Secondary metabolite compounds derived from bay leaves can be a source of antioxidants (Bhadreswara & Susanti, 2023), (Herlianto et al., 2023), (Tambunan et al., 2024). Previous research has stated that bay leaf extract has very strong antioxidant activity (Islamiyati & Saputri, 2018), with the highest activity in old leaves (Bahriul & Rahman, 2014). The chemical content found in bay leaves includes steroids, saponins, tannins, essential oils, phenolics, and flavonoids (Putri et al., 2020), (Nazirah et al., 2023), (Tambunan et al., 2024), with the main component of flavonoids as antioxidants (Bhadreswara & Susanti, 2023).

Skin problems caused by free radicals can be prevented with topical preparations rich in antioxidants, one of which is toner (Mukhlisa et al., 2025). Toner is a liquid preparation that functions to clean residual dirt, provide freshness, and moisturize facial skin (Ahda et al., 2022). Several studies have succeeded in formulating bay leaf extract into various preparations, including masks, lotions, ointments, gels, creams, patches, serums, and body scrubs. No research has been found on toner from bay leaf extract. Based on this background, research was conducted on the formulation of toner from bay leaf extract, with the aim of determining the physical quality and antioxidant activity of toner from bay leaf extract (Rahayu et al., 2024).

Research Method

Materials

The materials used include bay leaves, glycerin, sodium gluconate, polysorbate 20, distilled water, ethanol p.a (Merck), oleum rosae, n-Hexane, ethyl acetate, DPPH powder (Sigma Aldrick). The tools used include glassware (Iwaki), oven (Capp), analytical balance (Namesa), pH meter, spatula, brookfield viscometer, UV-Vis spectrophotometer (Raptor), water bath (Equitron), power grinder, 60 mesh sieve, whatman 40 filter paper, dropper pipette, and aluminum foil.

Simplicia and Extract Preparation

Bay leaves were obtained from Wonogiri and determined at the Tawangmangu Traditional Health Service Functional Implementation Unit of Dr. Sardjito General Hospital. Bay leaves were selected as old, fresh, green, and intact leaves. The bay leaves that had been

taken were wet sorted and washed. The bay leaves were chopped and dried using an oven, and the resulting simplicia was weighed. After that, the simplicia was ground using a blender to facilitate the extraction process (Abdurrahman et al., 2019), (Jamilatun, Rahmadianty, et al., 2023). The sifted simplicia powder was extracted using the maceration method. 400 g of bay leaf simplicia was soaked in 96% ethanol solvent as much as 4 L for 3x24 hours. The sample was then filtered, and the macerate obtained was evaporated in a water bath at a temperature of 50℃ to obtain a thick extract (Abdurrahman et al., 2019). The rendement was calculated using the formula:

$$\%\text{Rendement} = \frac{Extract\ Weight}{Simplicia\ weight} \text{ x } 100\%$$

Formulation and Preparation of Bay Leaf Extract Toner

Table 1. Formula for Bay Leaf Extract Toner

Material	Function	Weight per Formula			
		F0	**F1**	**F2**	**F3**
Bay leaf extract	Active substance	0%	1,5%	3%	6%
Glycerin	Humectant	2%	2%	2%	2%
Polysorbate 20	Emulsifier	5%	5%	5%	5%
Sodium gluconate	Stabilizer	0,2%	0,2%	0,2%	0,2%
Ethanol	Solvent	qs	qs	qs	qs
Oleum rosae	Fragrance	0,1%	0,1%	0,1%	0,1%
Aquadest	Solvent	Ad 100	Ad 100	Ad 100	Ad 100

Description: F0 = toner base that does not contain active ingredients. F1 = toner with the addition of 1.5% bay leaf extract. F2 = toner with the addition of 3% bay leaf extract. F3 = toner with the addition of 6% bay leaf extract.

The production of toner from bay leaf extract refers to previous research (Noor et al., 2023). The ingredients are prepared according to the formula in Table 1. The production of toner is carried out in the following manner. Bay leaf extract with variations of 1.5% (F1), 3% (F2), and 6% (F3) is dissolved with distilled water and then filtered. Furthermore, glycerin, sodium gluconate, ethanol, and polysorbate 20 are dissolved and stirred until homogeneous. After that, the dissolved extract is added little by little, and oleum rosae is added to the mixture. Distilled water is added while stirring until homogeneous, then filtered using filter paper and put into a bottle.

Physical Quality Test of Bay Leaf Extract Toner

Physical quality tests consist of organoleptic tests, pH tests, and viscosity tests. Organoleptic tests are carried out by putting the toner into a glass beaker as much to 10 ml, then observing the color, odor, and shape using the five senses (Andiva et al., 2023), (Jamilatun, Rusita, & Sari, 2025), (Jamilatun, Lukito, & Rayhanissa, 2025). pH tests are carried out by putting the toner into a glass beaker as much to 20 ml. The pH meter electrode is dipped into the toner, then the scale moves and waits until the number does not change. The number that appears on the pH meter is observed (Jamilatun, Utami, & Tolkhah, 2025), (Jamilatun, Lukito, & Rayhanissa, 2025). Viscosity tests are carried out using a viscometer. The toner is placed in a glass beaker,

then the spindle that has been installed is lowered until it is immersed in the preparation (Jamilatun, Lukito, et al., 2023).

Antioxidant Test of Bay Leaf Extract Toner Preparation

Antioxidant test refers to previous studies (Apitalau et al., 2021), (Jamilatun, Lukito, & Prasetyo, 2025), (W. Wahyuni et al., 2023). 1) Preparation of Standard Solution. 2.5 mg of DPPH powder is dissolved with ethanol p.a. up to 50 ppm in a 50 ml measuring flask. The solution that has been made is left in a dark place or protected from light. 2). Preparation of Blank Solution. 2 ml of ethanol p.a. is pipetted into a test tube, and 2 ml of 50 ppm DPPH solution. The solution is shaken until homogeneous and left in a dark place or protected from light for 30 minutes. Then the solution is measured at a wavelength of 500-530 nm. 3) Preparation of the Sample solution. 10 mg of toner is dissolved with ethanol p.a. in a 10 ml measuring flask. So that the concentration of the sample solution is 1000 ppm. Then the sample solution is made with variations in concentration of 10 ppm, 50 ppm, 100 ppm, 150 ppm, and 200 ppm in a 5 ml measuring flask. 4) Antioxidant Activity Test. Each of the sample solutions with varying concentrations was pipetted as much as 2 ml, and the DPPH solution was pipetted as much as 2 ml. The two solutions were mixed in a 1:1 ratio, shaken until homogeneous, and left for 30 minutes in a dark place or protected from light. The absorbance of the test solution was measured at a maximum DPPH wavelength of 50 ppm. Measurements were made using a UV Vis spectrophotometer. After the absorbance is obtained, it can be calculated using the result parameters that are usually used to interpret the results of the antioxidant activity test using the DPPH method, namely the IC_{50} value. The IC_{50} value is the concentration that causes a loss of 50% of DPPH activity. To calculate the IC_{50} value using the linear regression equation y = a + bx. Percent inhibition data is required from the test carried out (Apitalau et al., 2021). Percent inhibition can be calculated using the following formula:

$$\%\text{Inhibition} = \frac{Blank\ absorbance - Absorbance\ test}{Blank\ absorbance} \times 100\%$$

Results and Discussion

Table 2. Physical Quality and Antioxidant Activity of Bay Leaf Extract Toner

Formulas	Organoleptic			pH	Viscosity (cP)	Antioxidant Activity	
	Color	Smell	Texture			IC_{50} Value (ppm)	Category
F0	Clear	Oleum rosae	Liquid	5,10	3,09	195,625	Weak
F1	Greenish Brown	Bay leaf extract	Liquid	4,96	3,63	57,0859	Strong
F2	Light brown	Bay leaf extract	Liquid	4,74	3,81	46,090	Very strong
F3	Dark brown	Bay leaf extract	Liquid	4,50	3,88	24,048	Very strong

Description: F0 = toner base that does not contain active ingredients. F1 = toner with the addition of 1.5% bay leaf extract. F2 = toner with the addition of 3% bay leaf extract. F3 = toner with the addition of 6% bay leaf extract.

This study was conducted with the aim of determining the physical quality and antioxidant activity of toner from bay leaf extract. The physical quality of the toner observed included organoleptic, pH, and viscosity. The extraction process was carried out by maceration, obtaining a thick bay leaf extract of 50.3439 grams with an extract yield of 12.58%. These results are from previous studies, the yield of bay leaf extract obtained was 10.62% (Hikmah et al., 2016). The requirement for a thick extract yield is that the value is not less than 10% (Kementerian Kesehatan RI, 2023). The yield value is related to the active compounds contained in a sample, where the higher the yield value, the more active compounds there are (Aklimah & Ekayanti, 2022).

The formulation of bay leaf extract toner in this study refers to previous studies that have been modified (Noor et al., 2023), (Apitalau et al., 2021). The ingredients used include glycerin, which is a humectant, functions to improve the stability of a material over a long period and can protect components that are strongly bound in the material including water, fat, and other components. Humectants can moisturize the skin in high humidity conditions (Jamilatun, Lukito, & Rayhanissa, 2025). Polysorbate 20 is used to dissolve essential oils and pure natural compounds. Ethanol p.a is used as a solvent that is safe for use in cosmetic and food products (Chen et al., 2020). Aquades as a solvent. Oleum rosae is a fragrance. The formulation of bay leaf extract toner preparation is made into 4 formulas, namely F0 as a blank or base without bay leaf extract content, F1 contains 1.5% bay leaf extract, F2 contains 3% bay leaf extract, and F3 contains 6% bay leaf extract.

Organoleptic testing of bay leaf extract toner includes color, odor, and shape. Based on the results of the organoleptic test in Table 2, F0 is clear with the smell of oleum rosae and liquid form. The clear color in F0 is due to the absence of any additional extract in the formulation. The results of the organoleptic color test in F1, F2, and F3 are greenish brown, light brown, and dark brown, respectively. The difference in color in each formula is due to the difference in the amount of bay leaf extract added. The odor and shape of the toner in F1, F2, and F3 are typical of bay leaf extract in liquid form.

The results of the pH test of the bay leaf extract toner are by Table 2. The pH of the bay leaf extract toner is 5.10 (F0), 4.96 (F1), 4.74 (F2), and 4.50 (F3). The pH in the four formulations ranges from 4.54-4.97; these results indicate that these four formulas are safe to use. This is by previous research, the pH value of the toner was 4.94-5.18 (Karami et al., 2023). A good pH range for the skin is between 4.5-6.5 (Azizah et al., 2024). The preparation has met the criteria for skin pH, according to SNI standards (W. Wahyuni et al., 2023). Topical preparations must meet these requirements because if the pH is too high, it will cause the skin to become scaly, while if it is too acidic, it will irritate the skin (Jamilatun, Pratiwi, et al., 2024). The higher the concentration of the extract, the lower the pH value, causing the preparation to become more acidic (Jamilatun, Kholisna, et al., 2024). It is known that bay leaf extract contains flavonoids, which are phenolic compounds, so that they can cause a decrease in pH in the preparation formulation (Aklimah & Ekayanti, 2022).

The viscosity test results of bay leaf extract toner according to Table 2 the viscosity is respectively 3.09 cP (F0), 3.63 cP (F1), 3.81 cP (F2), and 3.88 cP (F3). The increase in viscosity value occurs because the higher the addition of bay leaf extract concentration, the amount of water in the toner decreases, so that the toner becomes thicker. The viscosity test results meet the standard requirements, namely >5 Cp (Azizah et al., 2024).

Antioxidant activity testing was carried out by calculating the inhibitory concentration (IC_{50}). The IC_{50} value is the concentration of extract that provides 50% antioxidant activity compared to the control through a linear regression line equation between the levels and the % radical scavenger (Jamilatun, Lukito, & Rayhanissa, 2025). In this study, the results of the antioxidant activity of bay leaf extract toner are obtained according to Table 2. The IC_{50} values were respectively 195.625 ppm (F0), 57.0859 ppm (F1), 46.090 ppm (F2), and 24.048 ppm (F3). The sample is said to have very strong antioxidant activity if the IC_{50} value is <50 ppm; strong if the IC_{50} value is between 50-100 ppm; moderate if the IC_{50} value is between 100-150 ppm; weak if the IC_{50} value is 151-200 ppm and very weak if the IC_{50} value is >200 ppm (Winarsih, 2017). Antioxidant activity in F0 is weak because it does not contain bay leaf extract; F1 is in the strong category, and F2 and F3 are very strong. These results are by the statement that the antioxidant activity of old bay leaf extract is classified as very strong (Bahriul & Rahman, 2014). The difference in antioxidant activity in F0, F1, F2, and F3 is due to the difference in the addition of extract concentration. The higher the amount of extract added, the higher the antioxidant activity (Jamilatun, Lukito, & Rayhanissa, 2025). Bay leaves contain several secondary metabolite compounds, with the main component being flavonoids, which have the potential as antioxidants. Flavonoid compounds act as hydrogen donors against free radicals (Bhadreswara & Susanti, 2023), (Aklimah & Ekayanti, 2022). The very high antioxidants in bay leaves are also supported by the presence of active ingredients with antioxidant effects, such as vitamin C, vitamin E, tannins, and saponins (Suleman et al., 2023)

Conclusion

Bay leaf extract can be formulated as a toner preparation. The physical quality of bay leaf extract toner shows organoleptic results with liquid form in all formulas, clear color with oleum rosae odor in F0, greenish brown color with bay leaf extract odor in F1, light brown color with bay leaf extract odor in F2, dark brown color with bay leaf extract odor in F3. pH consecutively 5.10 (F0); 4.96 (F1); 4.74 (F2); 4.50 (F3). Viscosity consecutively 3.09 cP (F0); 3.63 cP (F1); 3.81 cP (F2); 3.88 cP (F3). Antioxidant activity obtained IC_{50} values consecutively of 195.625 ppm (weak) in F0; 57.0859 ppm (strong) in F1; 46,090 ppm (very strong) in F2; and 24,048 ppm (very strong) in F3.

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