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QUALITY TEST OF SAPPANWOOD (*Caesalpinia sappan* L.) EXTRACT TONER

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ABSTRACT
The skin is the body's outermost organ that continuously interacts with the surrounding environment. Free radical exposure, unpredictable weather, and outdoor activities cause skin damage, necessitating the use of skincare products such as toners containing antioxidants. Natural antioxidants could be obtained from woody plants like sappanwood (*Caesalpinia sappan* L.). This research aimed to create a toner preparation from sappanwood extract and test the physical quality of the preparation. The quality tests conducted on the toner preparation included organoleptic, pH, homogeneity, and viscosity tests. The method used in this research was quantitative descriptive. The toner preparation was made in four variations of sappanwood extract concentrations: 0%, 1%, 2%, and 4%. The organoleptic test results showed that all four formulas had a liquid form and an oleum rosae scent. F0 was clear in color, FI was red, FII was dark red, and FIII was reddish-brown. The pH test results for F0, FI, FII, and FIII were 5.43±0.015, 5.16±0.006, 5.02±0.006, and 4.96±0.006, respectively. The homogeneity test results for all four formulas showed homogeneous results, with no coarse particles or clumps. The viscosity test results F0, FI, FII, and FIII were 3.17±0.058 cP, 3.67±0.058 cP, 3.83±0.058 cP, and 3.97±0.058 cP, respectively. The results of the organoleptic, pH, homogeneity, and viscosity tests indicated that the sappanwood extract toner preparation met the requirements for a skin-cleansing toner.

Keywords: Toner; Sappanwood; Quality Test

1. INTRODUCTION

Skin is the outermost organ of living beings that protects the body from disturbances in the surrounding environment. Skin makes up approximately 15% of the total human body weight. Skin damage can affect both health and appearance; therefore, proper protection and care are essential (Akbar et al., 2020). Factors such as weather changes and daily activities, both indoors and outdoors, can trigger various skin problems such as dullness, flaking, blackheads, excess oil production, and acne (Madikizella & Astuti, 2020). Another major cause of skin damage is exposure to free radicals. According to Ahmad et al. (2022), free radicals can damage skin due to their reactive nature and ability to attract electrons to achieve stability. One effort to reduce skin damage is by using skincare products such as toners containing antioxidants.

Natural antioxidants can be obtained from various plants, for example, woody plants like sappanwood, which has an IC_{50} of 33.78 ppm (Salsabila & Fuadi, 2023), flowers like butterfly pea flower which has an IC_{50} of 41.36 ppm (Andriani & Murtisiwi, 2020), leaves like gotu kola leaves which have an IC_{50} of 78.26 ppm (Yahya & Nurrosyidah, 2020), and fruits like cucumber which has an IC_{50} of 189.261 ppm (Agustin & Gunawan, 2019). Based on these research results, it can be seen that wood extracts have the lowest IC_{50} value compared to other plant extracts. A lower IC_{50} value indicates stronger antioxidant activity. Thus, sappanwood has the strongest antioxidant activity compared to other plant extracts. Other research results also show that

sappanwood extract has a lower IC_{50} value compared to other wood extracts such as cinnamon extract (IC_{50} 74.18 ppm) (Rosa et al., 2023) and rose apple stem wood extract (IC_{50} 40.12 ppm) (Fauziah et al., 2019).

According to the antioxidant activity classification proposed by Blois (1958) and widely adopted in phytochemical research, antioxidant strength is categorized based on IC_{50} values: very strong (IC_{50} < 50 ppm), strong (IC_{50} 50-100 ppm), moderate (IC_{50} 100-200 ppm), and weak (IC_{50} > 200 ppm). Based on this classification system, sappanwood extract, with an IC_{50} value of 33.78 ppm, falls into the very strong antioxidant category (Salsabila & Fuadi, 2023). Sappanwood contains several antioxidant compounds such as brazilin (homoisoflavonoid), saponins, terpenoids, and tannins (Hadi et al., 2023). Nurullita & Irawati (2022) also revealed that the antioxidant activity of sappanwood comes from the isolation of flavonoid compounds. Sappanwood (*Caesalpinia sappan* L.) which has very strong antioxidant activity can be used as a raw material for making toner preparations.

Toner is a liquid preparation used to cleanse and refresh the face. A toner is applied after washing the face with soap. According to Alviniari (2019), toner can remove makeup residue and dirt, remove excess oil without drying sensitive skin, and restore the skin's natural pH. Research on developing toners from natural ingredients has been widely conducted, such as toners from jasmine flower extract (Karami et al., 2023), toners from the bitter melon extract (Noor et al., 2023), and toners from arrowroot tubers (Ahda et al., 2022), but there has been no research utilizing sappanwood as a natural ingredient for making toners. In addition, sappanwood extract contains brazilin compounds that produce a red color, so this sappanwood extract toner does not require the addition of colorants to enhance the appearance of the preparation.

In the production of sappanwood extract toner preparations, quality tests need to be conducted to determine whether the preparations meet the requirements for toner preparations or not. The quality tests for toner preparations that need to be carried out include organoleptic tests, pH, homogeneity, and viscosity tests (Noor et al., 2023). Organoleptic tests are conducted to examine the physical appearance of a preparation including examination of the color, form, and odor of the preparation (Rismawati et al., 2020). Homogeneity tests are to examine the mixing of particles in the preparation (Sari et al., 2021). pH tests measure the acidity and alkalinity of the preparation and ensure the compatibility of the preparation's pH with skin pH (Karami et al., 2023). Viscosity tests determine the thickness level of the preparation (Noor et al., 2023).

Based on the above background, this research involves the production of toner preparations from sappanwood extract (*Caesalpinia sappan* L.) and quality testing of the preparations in the form of organoleptic, homogeneity, pH, and viscosity tests. This research aims to provide an alternative toner preparation made from natural ingredients containing antioxidants, namely sappanwood extract.

2. METHODS

2.1 Materials and tools

This research utilized the following materials: sappanwood (*Caesalpinia sappan* L.), 96% ethanol (Merck), glycerin (Wilmar), polysorbate 20, phenoxyethanol, distilled water, oleum rosae, and buffer solutions. The equipment used in the research included: Labex brand analytical balance, blender, beaker glass, stirring rod, 60 mesh sieve, jar, glass funnel, filter paper, porcelain dish, water bath, dropper pipette, volumetric pipette, measuring cylinder, volumetric flask, test tubes with a rack, micropipette, watch glass, object glass, pH meter, Brookfield viscometer, and aluminum foil.

2.2 Procedure

The research procedure for the preparation and quality testing of sappanwood extract toner included:

2.2.1. Preparation of raw materials

The sappanwood used was in the form of red shavings (Taufik, 2016). These shavings were cut into small pieces, ground using a blender, and sieved with a 60 mesh sieve until sappanwood simplicia in powder form were obtained (Leo et al., 2022; Ramani et al., 2021).

2.2.2. Preparation of sappanwood extract

Sappanwood powder (300 g) was extracted through maceration method for 2 x 24 hours using 3000 mL of 96% ethanol as solvent. This process was conducted in a closed container, protected from light, and stirred periodically every eight hours. The maceration filtrate was filtered, collected, and then evaporated using a water bath at 50°C until a thick extract was obtained (Tanzaq et al., 2019).

2.2.3. Preparation of toner

The toner was prepared by mixing sappanwood extract (at concentrations of 1%, 2%, and 4%) with 20 mL of a mixture of distilled water and ethanol until homogeneous (Solution I). Separately, glycerin was mixed with polysorbate 20 and phenoxyethanol until homogeneous (Solution II). Subsequently, Solution II was gradually added to Solution I, followed by the addition of oleum rosae. The mixture was then filtered and diluted in a 100 mL volumetric flask with distilled water and ethanol until the desired volume was reached. After homogenization, the toner preparation was placed in prepared containers (Karami et al., 2023; Leo et al., 2022). The formulation of sappanwood extract toner is shown in **Table 1**.

Table 1. Sappanwood Extract Toner Formula

Materials	Formula (%)				Use
	F0	FI	FII	FIII	
Sappanwood Extract	-	1	2	4	Active substance
Glycerin	2	2	2	2	Humectant
Polysorbate 20	5	5	5	5	Emulsifier
Phenoxyethanol	0.5	0.5	0.5	0.5	Preservative
Oleum rosae	0.25	0.25	0.25	0.25	Fragrance
Distilled water	Add 100	Add 100	Add 100	Add 100	Solvent

Source: Modification (Karami et al., 2023; Leo et al., 2022)

2.2.4. Quality testing of toner preparation

Quality tests for the sappa wood extract toner preparation include organoleptic test, homogeneity test, pH test, and viscosity test.

1) Organoleptic test
   The prepared sappanwood extract toner was dropped onto a watch glass. Observations were made sensorially using the five senses to assess the color, odor, and form of the toner preparation (Karami et al., 2023).
2) Homogeneity test
   Sappanwood extract toner (3-5 drops) was placed between two object glasses. Observations were made to detect the presence of coarse particles in the preparation (Leo et al., 2022).
3) pH test
   Sappanwood extract toner (20 mL) was placed in a beaker glass. The pH testing of the toner preparation began with calibration using buffer solutions of pH 4, 7, and 10. Then the pH meter was turned on and the electrode was dipped into the beaker glass containing the sample. The pH value was recorded after the reading was stabilized (Sari et al., 2021). The

standard skin pH value is 4.5-6.5 (Rismawati et al., 2020) and the pH value for facial cleansers is 4.5-7.8 (SNI 16-4380-1996).

4) Viscosity test

Sappanwood extract toner (250 mL) was placed in a beaker glass. Viscosity measurement was performed using a Brookfield viscometer with rotor number 1 at a speed of 60 rpm (Noor et al., 2023). The viscosity of the toner preparation should not exceed 5 cP (Sari et al., 2021).

2.3 Data Analysis

Data were analyzed using a descriptive quantitative approach by comparing the quality test results of the toner preparation with established standards. Organoleptic and homogeneity data were assessed descriptively and qualitatively, while pH and viscosity data were analyzed by calculating the mean and standard deviation, then compared with the standard ranges for skin pH (4.5–6.5) and toner viscosity (< 5 cP). This analytical method was chosen because the study focused on evaluating the physical quality of the toner, making descriptive data interpretation sufficient without requiring inferential statistical tests.

3. RESULTS AND DISCUSSION

This research aims to create a toner preparation from sappanwood extract. The prepared sappanwood extract toner was then subjected to tests including organoleptic, homogeneity, pH, and viscosity tests. The purpose of these tests was to determine the quality (including organoleptic properties, homogeneity, pH, and viscosity) of the prepared sappanwood extract toner.

The main material used to make the toner preparation from the sappanwood extract was sappanwood obtained from Toko Jamu Akar Sari, located at Jalan Dr. Radjiman No.112 Kemlayan, Serengan District, Surakarta City, Central Java. Plant determination of the sappanwood simplicia was conducted at the UPF Laboratory of Traditional Health Services in Tawangmangu. The results of the determination test showed that the sample used to make the toner preparation was indeed sappanwood, with the species name *Caesalpinia sappan* L. from the Fabaceae family. The determination of sappanwood (*Caesalpinia sappan* L.) revealed the results presented in **Table 2**.

Table 2. Plant Determination Results of Sappanwood

Parameter	Results	Test Method or Technique
Plant Determination		
Family	Fabaceae	
Species	*Bianceae sappan* (L.) Tod	Organoleptic
Synonym	*Caesalpinia sappan* L.	

The sappanwood used to make the toner preparation was red in color (Taufik, 2016). Sappanwood shavings were cut into small pieces using scissors, then blended until smooth, and sieved using a 60 mesh sieve to obtain sappanwood simplicia in powder form (Tanzaq et al., 2019). The sappanwood powder was extracted using the maceration method (Ameliana et al., 2022). In this study, the maceration method was employed because it requires simple equipment, is easy to perform, and is suitable for extracting thermolabile compounds (heat-sensitive compounds) (Setyawardhani et al., 2021), such as flavonoids and tannins present in sappanwood (Hadi et al., 2023).

The maceration process was carried out using 300 g of sappanwood powder and 3000 mL of 96% ethanol for 2 x 24 hours. In this study, 96% ethanol was used because, according to Wendersteyt et al. (2023), 96% ethanol has good absorption properties, is non-toxic, and has the

ability to extract compounds of various polarities. The high ethanol concentration allows for better penetration into cell walls, resulting in higher yields. This is also consistent with the research findings of Salsabila & Fuadi (2023), which stated that using a higher solvent concentration in sappanwood extraction can produce higher yields.

In this study, the maceration filtrate was evaporated using a water bath at 50°C, and 21.7723 g of thick extract was obtained with a yield of 7.26%. This yield is comparable to other sappanwood extraction studies using similar methods, such as the research by Fardhyanti and Riski (2015) who obtained a yield of 6.316%, and Fatimah et al. (2015), who achieved an 8.11% yield. The obtained yield in this study (7.26%) falls within the acceptable range for sappanwood extraction (2.48-12.25%) reported in various studies Salsabila & Fuadi (2023), indicating that the maceration process was successful and efficient for extracting bioactive compounds from sappanwood.

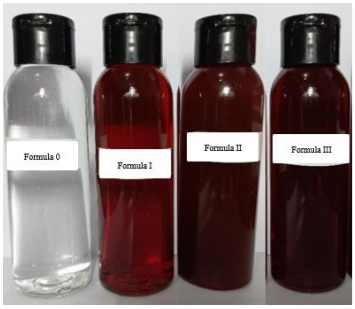
The toner formula used in this study was modified by changing the type and concentration of the active ingredient. This formula refers to the research of Karami et al. (2023), which studied the formulation and stability test of jasmine flower extract toner (*Jasminum sambac* L.). The sappanwood extract toner preparation in this study was made in four formulas: F0, FI, FII, and FIII. Formula 0 (F0) serves as a negative control containing the base toner formula without the addition of sappanwood extract. This control formula is essential for evaluating the baseline properties of the toner base and demonstrating that any observed effects are specifically attributable to the sappanwood extract rather than other formulation components. Additionally, F0 allows for comparison of physical and chemical properties of the formulated toners, ensuring that changes in stability, pH, or other parameters are due to the active ingredient concentration rather than formulation inconsistencies. The formula I (FI) contains 1% sappanwood extract, formula II (FII) contains 2% sappanwood extract, and formula III (FIII) contains 4% sappanwood extract. Each formula of the sappanwood extract toner preparation was made in 100 mL quantities.

The prepared toner was then subjected to quality testing. The quality testing parameters in this study included: organoleptic tests, homogeneity, pH, and viscosity. Organoleptic tests use human senses to examine the physical appearance of the prepared toner. The examination included the color, odor, and form of the preparation (Rismawati et al., 2020). The organoleptic test results of sappanwood extract toner are presented in **Table 3**.

Table 3. Organoleptic Test Results of Sappanwood Extract Toner

Formula	Organoleptic Characteristics		
	Color	**Odor**	**Form**
F0	Colorless	Oleum Rosae	liquid
FII	Red	Oleum Rosae	liquid
FII	Dark red	Oleum Rosae	liquid
FIII	Red Brown	Oleum Rosae	liquid

Explanation:
F0 : Formula without sappanwood extract
FI : Formula containing 1% sappanwood extract
FII : Formula containing 2% sappanwood extract
FIII : Formula containing 4% sappanwood extract



a) b) c) d)

Figure 1. Color Appearance of Sappanwood Extract Toner Formulation a) F0, b) FI, c) FII, and d) FIII

Based on the results of the organoleptic examination, it was found that the difference between the four formulas lies in the color of the preparation (**Figure 1**). F0 is colorless because it is the toner base without the addition of sappanwood extract, while FI, FII, and FIII are red, dark red, and reddish-brown, respectively, as shown in Table 3. The toner preparations FI, FII, and FIII are red because the sappanwood extract contains brazilin compounds that produce a red color (Hadi et al., 2023). From FI to FIII, the resulting red color becomes increasingly intense. This is because the more sappanwood extract added, the more red color is produced, resulting in a more intense color of the preparation. This is consistent with the research results of Ramani et al. (2021), who formulated blush-on with sappanwood extract concentrations of 3%, 5%, and 7%, obtaining increasingly intense blush-on colors with higher concentrations of sappanwood extract used.

In the preparation of this sappanwood extract toner, oleum rosae fragrance was added to increase attractiveness, create a fresher scent, and minimize the characteristic woody smell of the sappanwood extract. As a result, the toner preparations in this study, both F0, FI, FII, and FIII, produced a characteristic rose scent. This is consistent with the research of Noor et al. (2023), who made a toner from bitter melon extract with the addition of oleum rosae fragrance, resulting in a toner with a characteristic rose scent.

All four formulas, F0, FI, FII, and FIII, have the same liquid form. This liquid form is in accordance with the specifications of toner preparations; toners should not have a thick consistency as it can cause stickiness on the skin and discomfort when used (Dwyer et al., 2023). This is consistent with the research results of Karami et al. (2023) who made an anti-acne toner preparation from jasmine flower extract that produced a liquid toner. Thus, it can be said that all four formulas of sappanwood extract toner, F0, FI, FII, and FIII, have met the recommended organoleptic requirements for toner preparations. The homogeneity test results of sappanwood extract toner can be seen in **Table 4**.

Table 4. Homogeneity Test Results of Sappanwood Extract Toner

Formula	Homogeneity Test Results	Standard (Ameliana et al., 2022)	Remarks
F0	No particles/clumps/ coarse grains	No particles/clumps/ coarse grains	Meets Standard/ Homogeneous
FI	No particles/clumps/ coarse grains		Meets Standard/ Homogeneous
FII	No particles/clumps/ coarse grains		Meets Standard/ Homogeneous
FIII	No particles/clumps/ coarse grains		Meets Standard/ Homogeneous

In Table 4, the homogeneity test of the sappanwood toner preparation showed that all four formulas, F0, FI, FII, and FIII, demonstrated homogeneous results, characterized by the absence of lumps or coarse grains in the preparation. This homogeneity can occur because the active ingredients are evenly mixed with the base, preventing the formation of clumps. A homogeneous preparation will allow the active ingredients contained in the preparation to spread evenly, resulting in maximum release of the active ingredients (Supriani et al., 2023). This is consistent with the research of Karami et al. (2023), who made a toner from jasmine flower extract that produced a preparation with evenly mixed particles, resulting in a clear appearance. A homogeneous toner preparation indicates that all ingredients used in the preparation can be perfectly mixed. Based on the homogeneity test results, it can be concluded that F0, FI, FII, and FIII meet the recommended homogeneity requirements for toner preparations.

The pH testing of the toner preparation was conducted to determine the acidity level and ensure its compatibility with skin pH, thus avoiding potential skin irritation. The standard pH range for skin is 4.5-6.5 (Rismawati et al., 2020). If the pH is too acidic, it can cause skin irritation, and if the pH is too alkaline, it can cause skin dryness and itching (Sari et al., 2021). Based on Table 5, the pH test results of the sappanwood extract toner preparation were as follows: F0 at 5.43 ± 0.015; FI at 5.16 ± 0.006; FII at 5.02 ± 0.006; and FIII at 4.96 ± 0.006. The pH analysis of the sappanwood extract toner yielded the results detailed in **Table 5**.

Table 5. pH Test Results of Sappanwood Extract Toner

Formula	pH ± SD	Standard (Rismawati et al., 2020)	Remarks
F0	5.43 ± 0.015	4.5-6.5	Meets Standard/Requirements
FI	5.16 ± 0.006		Meets Standard/Requirements
FII	5.02 ± 0.006		Meets Standard/Requirements
FIII	4.96 ± 0.006		Meets Standard/Requirements

The sappanwood extract toner preparation in F0 has the highest pH because there is no addition of sappanwood extract. The pH results obtained from FI to FIII show a decrease as the concentration of the active ingredient increases. This is consistent with the research of Leo et al. (2022) on the formulation of sappanwood ethanol extract serum, which showed that increasing the concentration of the active ingredient tends to lower the pH of the preparation. The pH range obtained for the sappanwood extract toner, which is 4.96-5.43, is still within the recommended skin pH range of 4.5-6.5 (Rismawati et al., 2020) and the SNI 16-4380-1966 range of 4.5-7.8. Therefore, it can be said that all four formulas of sappanwood extract toner, F0, FI, FII, and FIII, have met the recommended pH requirements for toner preparations. Additionally, viscosity testing of the sappanwood extract toner offered the findings summarized in **Table 6**.

Table 6. Viscosity Test Results of Sappanwood Extract Toner

Formula	Viscosity ± SD (cP)	Standard (Sari et al., 2021; SNI 16-4955-1998)	Remarks
F0	3,17 ± 0,058	< 5 cP	Meets Standard/Requirements
FI	3,67 ± 0,058		Meets Standard/Requirements
FII	3,83 ± 0,058		Meets Standard/Requirements
FIII	3,97 ± 0,058		Meets Standard/Requirements

Viscosity testing was conducted to measure the thickness of the sappanwood extract toner preparation using a Brookfield viscometer with rotor number 1 at 60 rpm. Based on Table 6, the viscosity test results of the sappanwood extract toner preparation were as follows: F0 at 3.17 ± 0.058 cP; FI at 3.67 ± 0.058 cP; FII at 3.83 ± 0.058 cP; and FIII at 3.97 ± 0.058 cP. The sappanwood extract toner in F0 has the lowest viscosity value compared to other formulas because F0 has no addition of sappanwood extract, resulting in the thinnest consistency. The viscosity values in this study increased with the addition of the active ingredient concentration. This is consistent with the research of Yukaputri (2023), which stated that the higher the concentration of active ingredients added to the preparation, the higher its viscosity. The viscosity range obtained for the sappanwood extract toner preparation in this study is 3.17-3.97 cP, which is still within the recommended limit for toner preparations, which is less than 5 cP (Sari et al., 2021). This result is in line with the research of Noor et al. (2023), who made a facial toner from bitter melon extract with an average viscosity value of 3.80 cP. Therefore, it can be said that all four formulas of sappanwood extract toner, F0, FI, FII, and FIII, have met the recommended viscosity requirements for toner preparations.

4. CONCLUSION

The organoleptic test results of the sappanwood extract toner preparation showed that all four formulas, F0, FI, FII, and FIII, had a liquid form and an oleum rosae scent. The F0 toner preparation was clear in color, FI was red, FII was dark red, and FIII was reddish-brown. The pH values of the toner preparations F0, FI, FII, and FIII were 5.43±0.015, 5.16±0.006, 5.02±0.006, and 4.96±0.006, respectively. The homogeneity test of the sappanwood extract toner preparation for all four formulas yielded homogeneous results. The viscosity values of the sappanwood extract toner preparations for F0, FI, FII, and FIII were 3.17±0.058, 3.67±0.058, 3.83±0.058, and 3.97±0.058 cP, respectively. The results of the organoleptic, homogeneity, pH, and viscosity tests of the sappanwood extract toner showed that all formulations (F0, FI, FII, and FIII) met the requirements for toner preparations. The development of sappanwood extract toner shows great potential in the cosmetic industry. The resulting formula variations demonstrate that sappanwood extract concentration can influence the product's color and pH characteristics, with a pH range of 4.96-5.43 which is compatible with human skin pH. This opens up opportunities for cosmetic manufacturers to develop toner formulations that are not only effective in providing antioxidant protection but also safe and compatible with various skin types. Further research is recommended to evaluate the clinical effectiveness of sappanwood extract toner, including long-term stability studies, potential anti-aging benefits, and its effects on various skin conditions related to free radical damage and premature aging.

5. ACKNOWLEDGMENT

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6. CONFLICT OF INTEREST

The authors declare no conflict of interest. The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. All authors have approved the manuscript and agree with its submission.

7. REFERENCES

Agustin, V., & Gunawan, S. (2019). Uji fitokimia dan aktivitas antioksidan ekstrak mentimun (*Cucumis sativus*). *Tarumanagara Medical Journal*, *1*(3), 662-667.

Ahda, A., Setyaningsih, D., Rosalia, R., Aziz, S., Lutfiah, S.L., Apriani, V.D., & Yuniarsih, N. (2022). Aktivitas Antioksidan dan Formulasi Toner Wajah Berbagai Bahan Aktif Alami: Review Jurnal. *Syntax Literate: Jurnal Ilmiah Indonesia*, *7*(6), 8680-8692.

Ahmad, F., Ningsih, S. N. R., & Yuniarsih, N. (2022). Aktivitas Antioksidan Serum Gel dari Ekstrak Biji Asam Jawa (*Tamarindus indica* L) sebagai Penangkal Radikal Bebas dan Pencerah Wajah. *Jurnal Health Sains*, *3*(6), 798–803.

Akbar, M. R. P. K., Hanik, F. P. M., Shabrina, A., & Zulfa, E. (2020). Formulasi spray gel ekstrak etanol biji kedelai (*Glycine max*) sebagai sediaan kosmetik tabir surya. *Jurnal Ilmu Farmasi dan Farmasi Klinik (JIFFK)*, *17*(2), 44–50.

Alviniari, D. M. (2019). *Uji stabilitas fisik dan praklinis face toner berbasis ikan kakap merah (Lutjanus sp.) dan kitosan* [Skripsi]. Institut Pertanian Bogor.

Ameliana, L., Wisudyaningsih, B., Nurahmanto, D., & Dianatri, Y. A. M. (2022). Pengembangan essence dari ekstrak kayu secang (*Caesalpinia sappan* L.). *Jurnal Ilmu Kefarmasian Indonesia*, *20*(1), 101–106.

Andriani, D., & Murtisiwi, L. (2020). Uji aktivitas antioksidan ekstrak etanol 70% bunga telang (*Clitoria ternatea* L.) dari daerah Sleman dengan metode DPPH. *Jurnal Farmasi Indonesia*, *17*(1), 70–76.

Badan Standardisasi Nasional. (1996). *SNI 16-4380-1996: Sediaan tabir surya*. Jakarta: BSN.

Dwyer, J. M., Lavoie, J., O'Donnell, K., Marlina, U., & Sullivan, P. (2011). Contracting for Indigenous Health Care: Towards Mutual Accountability. *Australian Journal of Public Administration*, *70*(1), 34–46.

Fardhyanti, D. S., & Riski, R.D. (2015). Pemungutan brazilin dari kayu secang (*Caesalpinia sappan L.*) dengan metode maserasi dan aplikasinya untuk pewarnaan kain. *Jurnal Bahan Alam Terbarukan*, *4*(1), 6-13.

Fatimah, S., Alimudin, A. H., & Jayuska, A. (2015). Pengaruh keasaman terhadap stabilitas pigmen cengkodok (*Melastoma malabathricum*), kayu secang (*Caesalpinia sappan* Linn) serta campuran keduanya. *JKK*, *4*(1), 91-95.

Fauziah, N., Noviyanti, & Musthapa, I. (2019). Pemanfaatan kayu batang jambu bol (*Syzygium malaccense* L.). Merr. & Perry) sebagai sumber antioksidan baru. *Jurnal Ilmiah Farmako Bahari*, *10*(1), 33–41.

Hadi, K., Setiami, C., Azizah, W., Hidayah, W., & Fatisa, Y. (2023). Kajian aktivitas antioksidan dari kayu secang (*Caesalpinia Sappan* L.). *Photon: Jurnal Sains dan Kesehatan*, *13*(2), 48–59.

Karami, M. R. A. N., Malahayati, S., Hidayah, N., & Budi, S. (2023). Formula dan uji stabilitas sediaan toner anti jerawat ekstrak bunga melati (*Jasminum sambac* L.). *Jurnal Farmasi SYIFA*, *1*(2), 68–76.

Leo, W. E., Rahayu, M. P., & Ekowati, D. (2022). Formulasi sediaan serum ekstrak etanol kayu secang (*Caesalpinia sappan* L.) sebagai antioksidan. *Journal of Biology*, *11*(2), 177–183.

Madikizella, F., & Astuti, M. (2020). Kelayakan masker tradisional daun kelor untuk perawatan kulit wajah kering. *Jurnal Tata Rias dan Kecantikan*, *2*(3), 110–113.

Noor, M., Malahayati, S., & Nastiti, K. (2023). Formula dan uji stabilitas sediaan toner wajah ekstrak buah pare (*Momordica charantia* L.) sebagai anti jerawat dengan variasi surfaktan. *Jurnal Riset Kefarmasian Indonesia*, *5*(1), 133–145.

Nurullita, U., & Irawati, E. (2022). Uji aktivitas antioksidan ekstrak etanol kayu secang (*Caesalpinia sappan* L.). *Jurnal MIPA*, *5*(1), 47–50.

Ramani, S., Himawan, H. C., & Kurniawati, N. (2021). Formula sediaan blush on ekstrak kayu secang (*Caesalpinia sappan* L.) sebagai pewarna alami dalam bentuk powder. *Jurnal Farmamedika*, *6*(1), 1–9.

Rismawati, D., Aji, N., & Herdiana, I. (2020). Pengaruh butylated hydroxyanisole terhadap stabilitas dan karakteristik emulgel kombinasi ekstrak jahe merah dan minyak peppermint. *Jurnal Ilmiah Kefarmasian*, *1*(2), 35–42.

Rosa, R., Usman, H., & Desra, A. (2023). Uji aktivitas antioksidan ekstrak kayu manis (*Cinnamomum burmanii*). *Jurnal Farmasi Sains dan Obat Tradisional*, *2*(1), 151–158.

Salsabila, A. F., & M. Fuadi, A. (2023). Pengaruh waktu maserasi dan konsentrasi pelarut etanol terhadap rendemen dan aktivitas antioksidan kayu secang. *Jurnal Teknik Indonesia*, *2*(2), 87–100.

Sari, D. Y., Ariansyah, S., Shinta, S., & Beniardi, W. (2021). Face tonic formulation from ethanol extract of *Maranta arundinacea* L. with variety of cosolvent and surfactant: propylene glycol and polysorbate 80. *Proceeding of 27th International Conference ADRI*, 34–39.

Setyawardhani, D. A., Saputri, C. M., & Ni'mah, N. (2021). Pembuatan dan uji organoleptik hand sanitizer dari daun mangga (*Mangifera indica*) dengan metode maserasi. *Equilibrium Journal of Chemical Engineering*, *4*(1), 1–7.

Supriani, Rahayu, K., Annastasya, A., Reinita, D. S., Azka, M., & Agustina, N. (2023). Kajian pembuatan masker wajah organik dari tanaman pegagan (*Centella asiatica*). *Jurnal Farmasetis*, *12*(2), 237–244.

Tanzaq, T. T., Agustina, R. D., Setiawati, K. E., & Cahyani, I. M. (2019). Uji aktivitas penangkapan radikal DPPH (1,1-diphenyl-2-picrylhdrazyl) ekstrak etanol kayu secang (*Caesalpinia sappan* L.). *Media Farmasi Indonesia*, *14*(1), 1461–1465.

Taufik AN. (2016). Perbandingan daya antioksidan ekstrak etanol kayu secang putih dan merah (*Caesalpinia sappan* L.). *Jurnal Ilmiah Mahasiswa Universitas Surabaya*, *5*(1), 1–16.

Wendersteyt, N. V., Wewengkang, D. S., & Abdullah, S. S. (2023). 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*. *Pharmacon*, *10*(1), 706–712.

Yahya, M. A., & Nurrosyidah, I. H. (2020). Antioxidant activity ethanol extract of gotu kola (*Centella asiatica* (L.) Urban) with DPPH method (2,2-Diphenyl-1-Pikrilhidrazil). *Journal of Halal Product and Research*, *3*(2), 106–112.

Yukaputri, A. (2023). *Formula lotion tabir surya ekstrak daun ungu (Graptophyllum pictum L.) dan penentuan nilai sun protecttion factor (SPF)* [KTI]. Poltekkes Kemenkes Surakarta.