BIOLOGY, MEDICINE, & NATURAL PRODUCT CHEMISTRY ISSN 2089-6514 (paper)
Volume 14, Number 1, April 2025 | Pages: 499-506 | DOI: 10.14421/biomedich.2025.141.499-506 ISSN 2540-9328 (online)

The Potential of Hanjuang Merah (*Cordyline fruticose*) Antibacterial Liquid Body Wash

Emy Rahayu[1], Lilih Rahmanina[1], Tupaida Pasaribu[1], Maulida[2], Mirnawati Dewi[1,*]
[1]Faculty of Mathematics and Sciences; [2]Faculty of Teacher Training and Education, Palangka Raya University, Indonesia.

Corresponding author*
mirnawatidewi22bio@mipa. upr. ac.id

Manuscript received: 22 January, 2025. Revision accepted: 22 July, 2025. Published: 31 July, 2025.

Abstract

The skin is the outermost layer of tissue that has the function of covering and protecting the surface of the human body. Unhygienic skin will trigger skin infections caused by various microorganisms. One of them is bacteria. Hanjuang merah (*Cordyline fruticosa*) is a type of plant that is often used as a traditional medicine, especially for the Dayak community. However, research on the use of the *Cordyline fruticosa* plant in producing liquid body wash formulations that are efficacious as antibacterial against *Staphylococcus aureus* has not been carried out so far. The purpose of this study is to identify the potential of *Cordyline fruticosa* as a formulation of liquid body wash formulations and to find the effectiveness of *Cordyline fruticosa* in inhibiting infections caused by *S. aureus* bacteria made in the form of liquid body wash. The method used in the extraction is maceration and the manufacture of liquid body wash according to the formulation that has been made, while the disc diffusion method with concentrations of 5% (F1), 10% (F2), and 15% (F3) is used in antibacterial tests. *Liquid body* wash preparations with the largest inhibitory zone level at a concentration of 15% (F3). The concentration of 15% (F3) is effective in inhibiting the growth of *S. aureus* bacteria which is characterized by the formation of an inhibition zone around the disk.

Keywords: Antibakteri; hanjuang merah leaves; Liquid body wash; *Staphylococcus aureus*.

INTRODUCTION

The skin is the outermost layer of tissue that functions to cover and protect the surface of the human body (Srisantyorini & Cahyaningsih, 2019). Skin infections occur when the skin is not maintained in a healthy condition. Skin infections are caused by germs, bacteria, and viruses that grow within the skin tissue. Therefore, maintaining skin health is necessary to prevent skin diseases (Rismanto *et al*., 2019). Efforts to keep the skin clean and healthy include regularly washing the entire body (bathing). Soap can be used to remove skin metabolites (such as sebum), dead skin layers, sweat residue, dirt, dust, and microorganisms (Mopangga *et al*., 2021). One type of bacteria that can cause infections is *Staphylococcus aureus. S. aureus* is a bacterium that has garnered attention in the healthcare sector because it is highly pathogenic and can cause serious infections (Puspadewi *et al*., 2017; Seran *et al*., 2020). A characteristic feature of *S. aureus* infections is necrotic inflammation, which can lead to abscess formation (Widiastuti & Pramestuti, 2018; Ballo *et al*., 2021).

Indonesia has more than 20,000 types of medicinal plants spread across the country, with approximately 300 species used for medicinal purposes. One of the traditional medicinal plants commonly used by the Indonesian community is *Cordyline fruticosa*. According to the Dayak Benuak community, the leaves and roots of the *Cordyline fruticosa* are widely used as remedies for dysentery, menstruation issues, and as treatment for burns (Andani *et al*., 2022). The antibacterial activity of *Cordyline fruticosa* extract is more effective in inhibiting S. aureus, which is a gram-positive bacterium. *Liquid body wash* is a pharmaceutical preparation commonly used to treat infected skin. Currently, many *liquid body wash* use chemicals such as *triclocarban*. *Triclocarban* is one of the most commonly used antibacterial agents in liquid soaps. However, the United States Food and Drug Administration (FDA) states that prolonged use can cause bacteria to develop antibiotic resistance (Fernanda *et al*., 2022).

Based on the aforementioned statements, much literatures has reviewed the use of natural ingredients in the formulation of *liquid body wash* preparations that have antibacterial properties. However, research on the use of the *Cordyline fruticosa* Plant in creating *liquid body wash* formulations that have antibacterial properties against S. *aureus* has not yet been conducted. This study aims to identify the potential of Andong Merah (Cordyline fruticosa) as a formulation ingredient for *liquid body wash* preparations and to determine the effectiveness of Cordyline fruticosa Leaves in inhibiting

infections caused by Staphylococcus aureus bacteria when made into a liquid body wash.

MATERIALS AND METHODS

Methods

This type of research is experimental by formulating a *liquid body wash* from the ethanol extract of Hanjuang merah leaves at the Peatland Science and Technology Development and Innovation Center (PSTDIC) Laboratory, University of Palangka Raya, Central Kalimantan. The extraction method used is maceration to produce a thick extract that will be made into three types of *liquid body wash* formulations. Testing of the *liquid body wash* formulations includes organoleptic tests, homogeneity tests, pH tests, foam height observation tests, and free alkali tests, as well as testing against S. *aureus* bacteria.

Materials

The research tools used include a blender, measuring cups, *beaker glass*, *erlenmeyer flask*, petri dish, analytical balance, label paper, *rotary evaporator*, *water bath*, filter paper, spirit lamp, autoclave, soap bottles, *handscoon, hot plate*, inoculation loop, gauze, cotton, sieve, stirring rod, black plastic bag, funnel, tweezers, disk paper, maceration container, Bunsen burner, spatula, *magnetic stirrer* (2 cm and 3 cm), adhesive tape, dropper pipette, calipers, pH meter, scissors, *aluminum foil*, and plastic *wrapping roll*. The research materials used include Hanjuang merah Leaves or Andong Merah (*Cordyline fruticosa*), 70% ethanol, distilled water, *Staphylococcus aureus bacterial* isolates, coconut oil (VCO), glycerin, *Nutrient* Agar (NA) media, 40% KOH, Sodium Lauryl Sulfate (SLS), Na-CMC, stearic acid, Phenoxyethanol, and Petrichor Manura oil *aromatherapy* (fragrance), phenolphthalein, and 0.1 N HCL.

Research Procedure

Collection, Sample Preparation, and Maceration of Hanjuang merah Leaf or Andong Merah (*Cordyline fruticosa*)

The samples used in this research are Hanjuang merah Leaves collected from the surrounding areas of Palangka Raya, Central Kalimantan. The powdered leaves (simplicia) of Hanjuang merah are weighed to 100 grams using 1000 ml of 70% ethanol solvent. The thick extract will be placed in a water bath for 1-3 days (Fernanda *et al*., 2022).

Preparation and Formulation of Liquid Body Wash with Hanjuang merah Leaf Extract

Table 1. Formulation of Liquid Body Wash Preparations.

Ingredients	Formulation Preparation			
	Blank (-)	F1 5%	F2 10%	F3 15%
Ethanol Leaf Extract Hanjuang merah Leaf	0	5	10	15
Coconut oil (VOC)	15 mL	15 mL	15 mL	15 mL
KOH 40%	8 mL	8 mL	8 mL	8 mL
Stearic Acid	0,5 g	0,5 g	0,5 g	0,5 g
Na-CMC	1 g	1 g	1 g	1 g
Sodium lauryl sulfat (SLS)	1 g	1 g	1 g	1 g
Petrichor manura oil aromatherapy	1 mL	1 mL	1 mL	1 mL
Phenoxyethanol	0,5 g	0,5 g	0,5 g	0,5 g
Distilled water	100 mL	100 mL	100 mL	100 mL

All the materials to be used are calculated and weighed according to the formulation. Coconut oil (VCO) amounting to 15 mL is added to a *beaker glass*, followed by the gradual addition of 9 mL of glycerin and 8 mL of 40% KOH, and the mixture is heated with a *hotplate* at a temperature of 70°C until it forms a paste (Mixture I). Then, Na-CMC is added until homogeneous. Next, stearic acid is added to a beaker glass containing the homogeneous Na-CMC (Mixture II).

Mixture I is added to Mixture II and homogenized using a magnetic stirrer. Then, *Sodium lauryl sulfate* (SLS) is dissolved in 10 ml of hot distilled water. Once dissolved, it is mixed with the *liquid body wash* and stirred until homogeneous. Next, phenoxyethanol is added to the soap formulation and stirred until homogeneous. After that, *Petrichor Manura oil aromatherapy* is added, which serves as the soap's fragrance. The final step is the addition of 100 ml of distilled water. The preparation of *liquid body wash* formulations is carried out at each concentration of ethanol extract form Hanjuang Merah Leaf.

Evaluation of the Liquid Body Wash Formulation with Hanjuang merah Leaf Extract or Andong Merah (Cordyline fruticosa)

- ***Organoleptic Test***

A *liquid body wash* that meets the standard is characterized by having a homogeneous liquid form,

with a distinctive color and odor (National Standardization Agency, 1996).

- ***Homogeneity Test***

A formulation preparation can be considered good if there are no other particles clumping together (Homogeneous) (Pratama et al., 2018).

- ***pH Determination Test***

Liquid body wash generally has a pH ranging from 8 to 11. However, specific pH values can be determined based on the characteristics and needs of certain users, such as those with sensitive skin or specific skin problems (Marhaba et al., 2021).

- ***Foam Height Observation Test***

The good foam stability range has a height of more than 9.5 cm (Riyanta & Nurniswati, 2016). The appropriate foam height requirement according to SNI ranges from 13-220 mm (National Standardization Agency, 1996).

- ***Free Alkali Test***

This test is conducted by weighing 5 grams of the *liquid body wash* and placing it in a 250 ml *beaker glass*, then adding 100 mL of 96% alcohol and 1 ml of indicator solution (phenolphthalein). The mixture is then heated on a *hot plate* for 30 minutes until boiling. The solution will turn purple and will be titrated with 0.1 N HCL solution until the purple color disappears (Korompis *et al*., 2020).

Antibacterial Activity Test of Staphylococcus aureus Against Hanjuang merah Leaf Liquid Body Wash

The effectiveness test of the *liquid body wash* uses S. *aureus* bacteria. Three petri dishes are prepared, and about 15 mL of Nutrient Agar (NA) medium is poured into each petri dish. It is allowed to solidify. Then, the bacterial preparation is taken and spread on the *Nutrient Agar* (NA) medium. Then, the disks are soaked in the *liquid body wash* preparation of Hanjuang merah Leaf extract or Andong Merah (Cordyline fruticosa) with variations of 5%, 10%, 15%, and a positive control for comparison using commercial *liquid body wash*. It is incubated for 24 hours at 37°C, and the average diameter of the inhibition zone is measured for each concentration.

RESULTS AND DISCUSSION

The formulated *liquid body wash* preparations obtained four types: *liquid body wash* without extract (blank), liquid body wash with 5% extract addition (F1), *liquid body wash* with 10% extract addition (F2), and *liquid body wash* with 15% extract addition (F3). Each treatment evaluated the *liquid body wash* formulation based on the SNI quality standard (06-4085-1996), including organoleptic tests, homogeneity tests, pH tests, foam height observation tests, and free alkali tests. Additionally, further testing was carried out against *Staphylococcus aureus* bacteria.

Figure 1. *Liquid Body Wash* Preparations.

Body wash is a product derived from sodium compounds and fatty acids used as a body cleanser, which produces foam and does not cause skin irritation. Body wash can be divided into two types based on its form: solid soap and liquid soap. Liquid soap effectively removes water-soluble and fat-soluble dirt on the skin surface, eliminates unpleasant odors, and provides a pleasant fragrance (Zagita et al., 2021).

Liquid soap is produced through a series of saponification reactions of fats and oils with KOH (Irmayanti *et al*., 2014; Ariyani & Hidayati, 2018). The process of mixing VCO oil, glycerin, and KOH is first carried out at 70°C, resulting in a soap base in paste form. The saponification reaction can proceed well at a temperature of 60-70°C; if the saponification process exceeds the specified temperature, it will cause the preparation to foam and overflow. In contrast, if the temperature is lower than the specified temperature, it will result in a non-homogeneous preparation (Sari & Ferdinan, 2017).

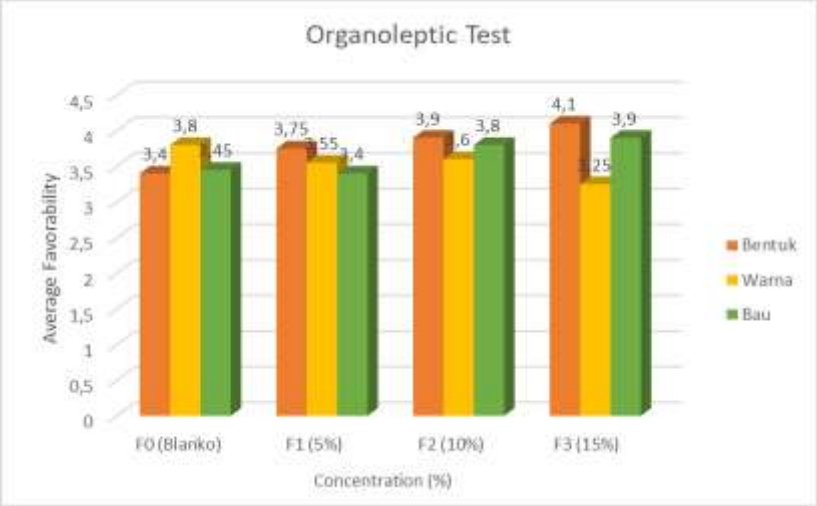
Organoleptic Test
According to the SNI (06-4085-1996) as follows.

Table 2. Organoleptic Test Results SNI (06-4085-1996).

Organoleptic test	F0 (Blank)	*Liquid Body Wash* of Red Ti Leaf Extract			Standard Test
		F1 5%	F2 10%	F3 15%	
Texture/Form	Liquid	Liquid	Semi Liquid	Thick	SNI (06-4085-1996)
Color	White	Cream	Kuning Vanila	Yellow	
Odor	Typical	Typical	Typical	Typical	

The organoleptic test aims to determine the characteristics of the *liquid body wash* formulation, including shape, color, and odor. Based on the results in Table 2, the preparations made have distinctive characteristics in each treatment. According to the SNI quality standard (06-4085-1996), the quality standard for organoleptic testing of *liquid body wash* includes having a liquid form, distinctive odor, and color.

Based on Panelist preference as follows.



Information: F0 (Blanko) = Without extract; F1 = Addition of extract 5 %; F2= Addition of extract 10 %; F3= Addition of extract 15%.
Description: 1. Very dislike; 2. Dislike; 3. Neutral; 4. Like; 5. Very like.

Figure 1. Panelist Organoleptic Tests.

Based on the assessment results on the organoleptic testing of each *liquid body wash* preparation includes an assessment of shape, color, and odor is included. The highest score indicates the panelists' preference for each *liquid body wash* preparation. The panelists showed that the most preferred shape and odor were F3 with 15% extract addition, while the most preferred color was F0 (Blank).

Homogeneity Test

Table 3. Homogeneity Test Results

Homogeneity Test	F0 (Blanko)	*Liquid Body Wash* Red Ti Leaf Extract			Test Standard
		F1 5%	F2 10%	F3 15%	
	Homogenous	Homogenous	Homogenous	Homogenous	SNI (06-4085-1996)

Figure 2. Homogeneity Testing.

The purpose of the homogeneity test is to determine whether the soap ingredients used are evenly mixed. In the preparations made, the blank preparation, F1 (5%), F2 (10%), and F3 (15%) all showed that each formulation was homogeneous. This can be confirmed by research conducted by Panaungi & Hasma (2022), which states that a *liquid body wash* formulation should show a homogeneous structure, indicated by the absence of coarse granules on a glass slide.

pH Level Test

Table 4. pH Level Test Results.

pH Level Test (pH)	F0 (Blank)	*Liquid Body Wash* Red Ti Leaf Extract			Test Standard
		F1 5%	F2 10%	F3 15%	SNI (06-4085-1996)
	8, 77	8,34	8,11	8,41	

Figure 3. pH Level Testing.

The pH test aims to determine whether the *liquid body wash* preparation is acidic, basic, or neutral. The pH measurement was carried out using a calibrated pH meter. The pH test results showed variations at each concentration (Table 4). The results indicate that the pH of the *liquid body wash* ranges from 8 to 8.41 (<11). Based on each *liquid body wash* preparation, all formulations meet the SNI (06-4085-1996) quality standards. pH testing is crucial to ensure that the *liquid body wash* does not cause skin irritation.

According to Sari & Ferdinan (2017), *liquid body wash* products generally have a basic pH due to the saponification process between KOH and VCO coconut oil. A *liquid body wash* with a pH that is too low (acidic) can increase the absorption capacity of the skin, leading to skin irritation.

Foam Height Observation Test

Table 5. Foam Height Observation Test Results.

Foam Height Observation Test	F0 (Blank)	*Liquid Body Wash* Red Ti Leaf Extract			Test Standard
		F1 5%	F2 10%	F3 15%	SNI (06-4085-1996)
	5 cm	7,5 cm	7 cm	7,5 cm	

Figure 4. Foam Height Observation Test.

The foam height test aims to determine the amount of foam produced by each preparation. The foam height range obtained is 5-7.5 cm. According to SNI 06-4085-1996, the foam height for *liquid body wash* preparations ranges from 1.3 to 22 cm, indicating that the preparations made meet the quality standards. According to Usman & Baharuddin (2023), foam with a stable structure is more effective at removing dirt from the skin. However, excessive use of foam stabilizers can cause skin irritation.

Foam height is influenced by several factors, including foam stabilizers, surfactants, and other components of the *liquid body wash*. Additionally, foam height can be affected by the addition of *Sodium Lauryl Sulfate* (SLS), which serves as an additive to produce optimal foam. However, the addition of SLS should not exceed 1% of the formulation (Pareda *et a*l., 2020).

Free Alkali Test

Table 6. Free Alkali Test Results.

Free Alkali Test	F0 (Blank)	*Liquid Body Wash* Red Ti Leaf Extract		Test Standard
		F1 5%	F2 10%	F3 15%	
	0,082%	0,083%	0,093%	0,054%	SNI (06-4085-1996)

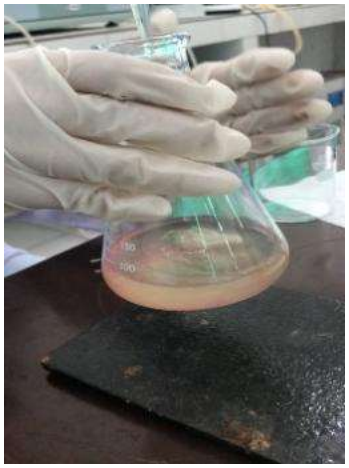


Figure 4. Free Alkali Test (Personal Documentation, 2024)

The free alkali test aims to determine the amount of unbound alkali with VCO oil, which will affect the quality of *the liquid body wash* preparation (Ariyani & Hidayati, 2018). Based on the results obtained, the free alkali values in the soap preparations range from 0.054% to 0.093% (**Table 6**). These values do not exceed the applicable quality standard of a maximum of 0.14%. According to Pareda et al. (2020), the free alkali test is one of the requirements for *a liquid body wash* formulation to be safe for use. The low free alkali content in the *liquid body wash* preparation is due to the long heating and mixing time of the *liquid body wash* ingredients, allowing KOH to react optimally with VCO coconut oil to form a paste (soap base) (Korompis et al., 2020).

Test of Cordyline fruticosa Extract

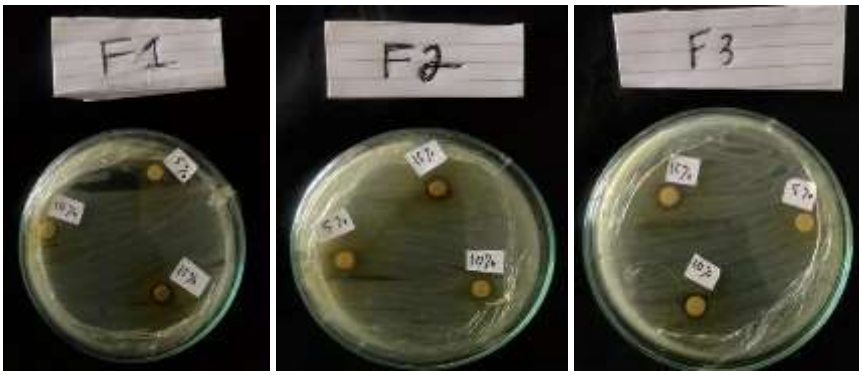
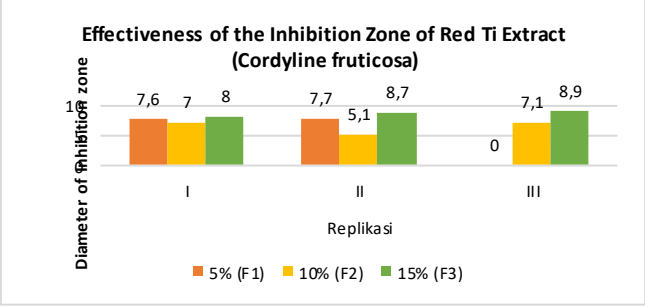


Figure 5. Test of Cordyline fruticosa Leaf Extract Note: 5% Extract (F1), 10% Extract (F2), 15% Extract (F3).



Graph 2. Effectiveness of Red Ti Leaf Extract (Cordyline fruticosa) Against Staphylococcus aureus

Based on the tests conducted across three replications, the leaf extract has the potential to inhibit bacterial growth with the largest inhibition zone diameter ranging from 8 to 8.9 mm at 15% treatment (F3) (Graph 2). Statistical testing using the One-Way Anova method shows a significance value of 0.343 > 0.05, indicating that Red Ti leaf extract is effective in inhibiting the growth of *Staphylococcus aureus* bacteria. Red Ti leaves contain secondary metabolite compounds such as flavonoids, alkaloids, tannins, and saponins, which have proven antibacterial properties (Nurhayati *et al*., 2018). According to Indiyen et al. (2020), the antibacterial

activity of Red Ti leaf extract (*Cordyline fruticosa*) is more effective in inhibiting Gram-positive bacteria like *Staphylococcus aureus*.

Activity Test and Preparation of *Liquid Body Wash* with *Cordyline fruticosa* Leaf Extract

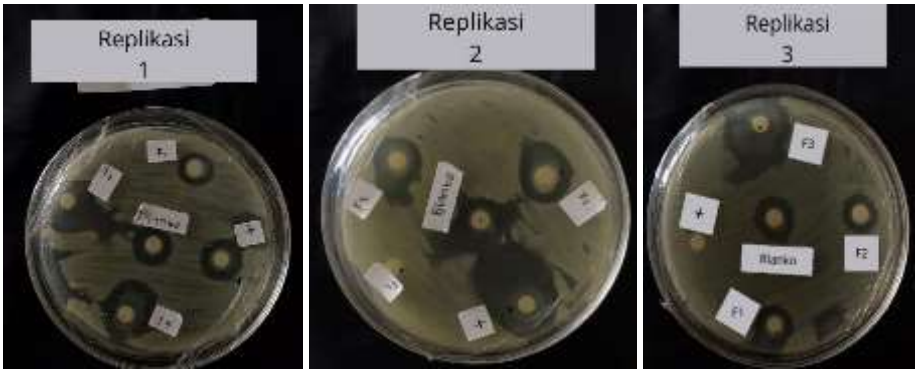
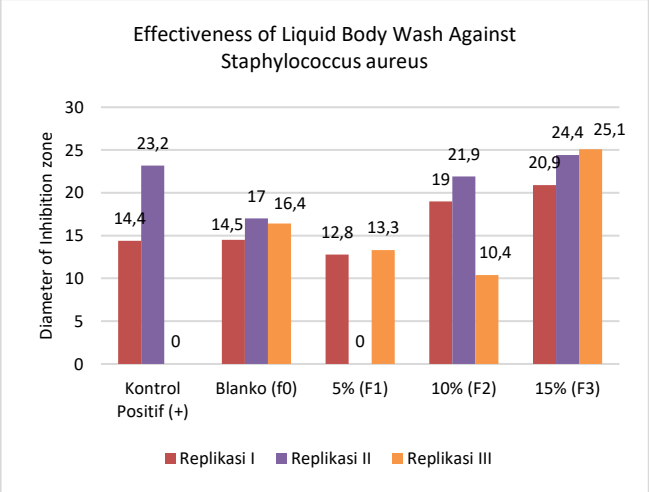


Figure 6. Testing *Liquid Body Wash* Preparation. Note: Positive Control (+), Blank (F0), 5% Extract Addition (F1), 10% Extract Addition (F2), 15% Extract Addition (F3).



Graph 3. Effectiveness of *Liquid Body Wash* Against *Staphylococcus aureus*

Based on the tests conducted across 3 replications, the preparation with the addition of Cordyline fruticosa leaf extract has the potential to inhibit bacterial growth with the largest inhibition zone diameter ranging from 20 to 25 mm at 15% treatment (F3) (**Graph 3**). Statistical testing using the One-Way Anova method shows a significance value of 0.183 > 0.05, indicating that the *liquid body wash* is effective in inhibiting the growth of *Staphylococcus aureus* bacteria. Cordyline fruticosa leaves contain secondary metabolite compounds responsible for inhibiting bacterial growth, including alkaloids and flavonoids. Alkaloids inhibit the synthesis of peptidoglycan in the cell, leading to bacterial cell death, while flavonoids form complexes with extracellular proteins, causing membrane leakage due to phospholipids' inability to maintain bacterial cell membrane shape (Ayuchecaria *et al*., 2024).

Results and Discussion should be written as a series of connecting sentences, however, for manuscript with long discussion should be divided into subtitles. Results should be clear and concise.

CONCLUSIONS

The optimal concentration for the thick extract test is 15% (F3) with the largest inhibition zone diameter ranging from 8 to 8.9 mm, while the optimal concentration for the *liquid body wash* preparation is 15% (F3) with the largest inhibition zone diameter ranging from 20 to 25 mm. This inhibition zone diameter is categorized as strong in inhibiting S. aureus bacterial growth.

Funding: We extend our thanks to the Ministry of Education, Culture, Research, and Technology for funding this research.

Authors' Contributions: Mirnawati Dewi & Emy Rahayu designed the study. Emy Rahayu, Lilih Rahmanina, Tupaida Pasaribu, Maulida, carried out the laboratory work. Emy Rahayu, Lilih Rahmanina analyzed the data. All authors read and approved the final version of the manuscript.

Competing Interests: The authors declare that there are no competing interests.

Acknowledgement: Thanks also to Palangka Raya University for providing the facilities and infrastructure necessary for the successful completion of this research.

REFERENCES

Andani, L., Sari, N. M., Salusu, H. D., Yusdiansyah, Wartomo, Prayitno, J., & Aryani, F. 2022. *Analisis Fitokimia, Aktivitas Antioksidan Dan Antibakteri Daun Andong*. *18*(2), 39–44.

Ariyani, S. B., & Hidayati. 2018. Penambahan Gel Lidah Buaya Sebagai Antibakteri pada Sabun Mandi Cair Berbahan Dasar Minyak Kelapa. *Jurnal Industri Hasil Perkebunan*, *13*(1), 11–18.

Ayuchecaria, N., Oksal, E., Martani, Sri, N., Komara, Kartika, N., Chuchita., & Pereiz, Z. 2024. Skrining Fitokimia dan Uji Antibakteri Ekstrak Etanol Daun Hanjuang Merah (*Cordyline fruticose*) Terhadap Bakteri *Staphylococcus epidermidis*. *Angewandte Chemie International Edition, 6(11), 951–952.*, *1*(Mei), 86–94.

Ballo, N. D. S., Indriarini, D., & Amat, A. L. S. S. 2021. Uji Aktivitas Anti bakteri Ekstrak Etanol Daun Kemangi (*Ocimum sanctum* L.) Terhadap Pertumbuhan Bakteri *Staphylococcus aureus* Secara In Vitro. *Cendana Medical Journal (CMJ)*, *9*(1), 83–93.

Korompis, F. C.., Yamlean, P. V. Y., & Lolo, W. A. 2020. Formulasi dan Uji Efektivitas Antibakteri Sediaan Sabun Cair Ekstrak Etanol Daun Kersen (*Muntingia Calabura* L.) Terhadap Bakteri *Staphlococcous epidermidis. Pharmacon*, *9*(1), 30.

Marhaba, F. A., Yamlean, P. V.., & Mansauda, K. L. R. 2021. Formulasi Dan Uji Efektivitas Antibakteri Sediaan Sabun Wajah Cair Ekstrak Etanol Buah Pare (Momordica Charantia L.) Terhadap Bakteri *Staphylococcus Epidermidis. Pharmacon*, *10*(13 mm), 1051.

Mopangga, E., Yamlean, P. V. Y., & Abdullah, S. S. 2021. Formulasi Sediaan Sabun Mandi Padat Ekstrak Etanol Daun Gedi (*Abelmoschus manihot* L.) Terhadap Bakteri *Staphylococcus epidermidis. Jurnal Pharmacon*, *10*(3), 1017–1024.

Nurhayati, P., Humairoh, D., & Fitri, I. 2018. Aktivitas Antibakteri Ekstrak Etanol 96 % Daun Andong Merah (*Cordyline Fruticosa* (L.) A. Chevas) Terhadap Bakteri *Klebsiella* sp. *FITOFARMAKA: Jurnal Ilmiah Farmasi*, *1*(1), 136–141.

Panaungi, A. N., & Hasma. 2022. Formulasi Sediaan Sabun Cair Dari Ekstrak Etanol Daun Kersen (*Muntingia calabura* L.). *Journal Syifa Sciences and Clinical Research (JSSCR)*, *4*(3), 781–782.

Pareda, N. K., Edy, H. J., & Lebang, J. S. 2020. Formulasi dan Uji Aktivitas Antibakteri Sabun Cair Kombinasi Ekstrak Etanol Daun Jati (*Tectona grandis* linn.f.) dan daun ekor kucing (Acalypha hispida burm.f.) Terhadap Bakteri *Staphylococcus aureus*. *Pharmacon*, *9*(4), 558.

Pratama, E., edi arief, A., & Farmasi Muhammadiyah Kuningan, A. 2018. Formulasi Sediaan Gargarisma Dari Ekstrak Buah Belimbing Wuluh (*Averrhoa bilimbi* L) Sebagai Anti Kandidiasis. *Jurnal FARMAKU (Farmasi Muhammadiyah Kuningan)*, *3*(2), 11–16.

Pertiwi, F. D., Rezaldi, F., & Puspitasari, R. 2022. Uji Aktivitas dan Formulasi Sediaan *Liquid Body Wash* dari Ekstrak Etanol Bunga Telang (*Clitoria ternatea* L) Sebagai Antibakteri *Staphylococcus epidermidis*. *Jurnal Ilmiah Kedokteran dan Kesehatan*, *1*(1), 53-66.

Rismanto, R., Yunhasnawa, Y., & Mauliwidya, M. 2019. Pengembangan Sistem Pakar Untuk Diagnosa Penyakit Kulit Pada Manusia Menggunakan Metode Naive Bayes. *Jurnal Ilmiah Teknologi Informasi Dan Robotika*, *1*(1), 18–24.

Riyanta, A. B., & Nurniswati. 2016. Adsorpsi Minyak Jelantah Menggunakan Karbon Aktif dan Serbuk Kopi pada Pembuatan Sabun Padat Ramah Lingkungan. *Journal Politeknik Harapan Bersama Tegal*, *1*(1), 118–123.

Sari, R., & Ferdinan, A. 2017. Pengujian Aktivitas Antibakteri Sabun Cair dari Ekstrak Kulit Daun Lidah Buaya Antibacterial. *Pharm Sci Res*, *4*(3), 111–120.

Seran, L., Herak, R., & Missa, H. 2020. Pembuktian Kemampuan Anti Bakteri Ekstrak Daun dan Kulit Jarak Pagar (*Jatropha culcas*) Terhadap Bakteri Staphylococcus aureus Secara In Vitro Dalam Pembelajaran Dengan Metode PBL Terhadap Mahasiswa Semester VII Program Studi Pendidikan Biologi FKIP UNWIRA. *Jurnal Studi Guru Dan Pembelajaran*, *3*(1), 39–50.

Srisantyorini, T., & Cahyaningsih, N. F. 2019. Analisis Kejadian Penyakit Kulit pada Pemulung di Tempat Pengolahan Sampah Terpadu (TPST) Kelurahan Sumur Batu Kecamatan Bantar Gebang Kota Bekasi. *Jurnal Kedokteran Dan Kesehatan*, *15*(2), 135.

Usman, Y., & Baharuddin, M. 2023. Uji Stabilitas dan Aktivitas Sabun Mandi Cair Ekstrak Etanol Daun Alpukat (*Persea americana* Mill.). *Jurnal MIPA*, *12*(2), 43–49.