Journal of Health Sciences and Medical Development
Vol. 2, No. 02, pp. 43-53
journal.iistr.org/index.php/HESMED
DOI: 10.56741/hesmed.v2i02.262

Development and Physical Stability Test of Salak Fruit Peel Extract Mouthwash as a Plaque Preventative

[1]Nasrawati Basir*, [1]Nurfiddin Farid, [1]Sriyanti Sadayam, [1]Andi Ulfiana Utari, [1]Andi Bibit Utari Rahayu
Corresponding Author: * nasrawatibasir@unimerz.ac.id
[1] Pharmacy Study Program, Faculty of Pharmacy, Universitas Megarezky, Indonesia

ARTICLE INFO

Article history
Received 28 January 2023
Revised 30 March 2023
Accepted 03 April 2023

Keywords
Mouthwash Preparation
Physical Stability Test
Salak Fruit Peel

ABSTRACT

The study aims to investigate the formulation and physical stability of salak peel extract mouthwash as a plaque preventer. Salak is a plant from Indonesia with medicinal properties, and its peel is a waste product that contains nutritional values such as protein, carbohydrates, water and low fat. The method used in this study is an experimental laboratory method. The salak peel was extracted through maceration of 96% ethanol and formulated into mouthwash with different concentrations of 5%, 10%, and 15%. The stability of the formulation was tested through organoleptic, pH, specific density, viscosity and clarity tests. The results showed no difference before and after the cycling test in organoleptic, pH, specific density, viscosity, and clarity tests, indicating the physical stability of the formulation.

This is an open-access article under the CC–BY-SA license.

Introduction

Good oral health is essential for daily interactions and socializing. Various oral problems can occur daily, including bad breath caused by plaque on teeth [1]. Plaque is an uncontrolled biofilm formation that can quickly thicken on the tooth surface. This biofilm is a mucous layer composed of millions of bacterial cells, saliva, and food residue [2]. Streptococcus mutans are one of the essential bacteria involved in plaque formation. This bacterium can form

extracellular polysaccharides, forming colonies that can stick to the tooth surface [3]. Dental and oral problems, especially plaque, are often neglected by citizens and governments because they do not directly threaten life. Therefore, plaque prevention can be done by rinsing with mouthwash, which serves as a microbial inhibitor. Using mouthwash is highly effective because it reaches areas that are difficult to clean with a toothbrush and can damage plaque. Mouthwash is a solution used to clean the mouth to improve oral health. Mouthwash can also kill the bacteria that cause plaque, eliminate bad breath, and prevent tooth damage [4].

In Indonesia, people have long used plants as medicine. Many species of plants are found in Indonesia, but many people are unaware that some plants can be used for treatment. The active ingredient in mouthwash formulations with antibacterial properties can come from chemicals or natural substances. People prefer traditional treatments (back to nature), so natural substances become notable highlights. One natural substance that can be used as the active ingredient for mouthwash is the skin of the salak fruit [1].

Salak is a plant from Indonesia that has healing properties. The part of the salak plant that has medicinal properties is its fruit skin. The skin of salak fruit is waste that is no longer used, but it contains nutritious values such as protein, carbohydrates, water and low fat. The skin of the salak fruit also has an antibacterial effect. Results and phytochemical tests show that the skin and flesh of the fruit contain alkaloids, tannins, and flavonoids [5].

Based on the research by Ref. [5], the extract of salak fruit skin with concentrations of 5%, 10%, 15%, and 20% showed that the extract of salak fruit skin could inhibit the growth of Streptococcus mutans bacteria and is categorized as a potent inhibition [5]. Salak fruit skin has excellent potential to inhibit and kill S. mutans, and its utilization as an active ingredient in mouthwash preparations is still not widely known. This study aims to determine the physical stability of salak peel extract mouthwash at concentrations of 5%, 10%, and 15% and its efficacy as a plaque preventer through analysis of organoleptic, pH, specific density, viscosity, and clarity tests.

Methods

A. Materials and Tools

The tools are a sieve, stirring rod, blender, 100 mL bottle, funnel, Erlenmeyer flask, measuring glass, beaker, parchment paper, and universal pH indicator paper. It also used mortar, water bath, rotary evaporator, spoon, stamper, reaction tube, analytical balance, glass jar, tissue, and viscometer. The materials used are distilled water, salak peel extract (Salacca zalacca), 96% ethanol, glycerin, sodium benzoate, peppermint oil, and sorbitol.

B. Sample Processing

The sample used in this research is the peel of the salak fruit. The salak peel sample was obtained in Dusun Layya, Cece Village, Alla Sub-District, Enrekang Regency. The salak peel was

first cleaned with running water to remove dirt, then drained and cut into small pieces and dried by allowing it to air dry and protected from sunlight until dry, then blended. The dried sample was weighed 800 g and then placed in a maceration jar, then added with the extraction solvent until the sample was fully immersed. The extraction solvent is about 3 cm above the surface of the raw material. Allow it to stand in a dark place for 3 days while stirring occasionally, then filter it through a flannel cloth and the residue is macerated again with 96% ethanol in a new amount. It was done 2 x 24 hours. The filtrate was evaporated using a rotary evaporator until a concentrated extract was obtained. Then, the extract obtained was weighed to determine its yield using the percentage formula.

C. Formulation of Salak Peel Extract Mouthwash

The mouthwash formulation uses peel extract, sodium benzoate, glycerin, sorbitol, distilled water, and peppermint oil. The salak peel extract used was 5%, 10%, and 15%. The composition of the mouthwash formula can be seen in the table.

Table 1. Mouthwash formulations

Material	Function	Concentration (% w/v)				Range
		F0	F1	F2	F3	
Salak fruit skin extract	Active substance	-	5	10	15	-
Sodium benzoate	Preservative	0.1	0.1	0.1	0.1	0.01-0.5%
Glycerin	humectants	5	5	5	5	≤30%
Sorbitol	Sweetener	8	8	8	8	5-20%
Peppermint oil	Taste	0.15	0.15	0.15	0.15	-
Distilled water ad.	Solvent	100 ml	100 ml	100 ml	100 ml	-

Povidone iodine mouthwash formula

D. Preparation of mouthwash from bark extract of salak fruit (Salacca zalacca)

The procedure for making mouthwash using Salacca zalacca fruit skin extract:

1. Formula 1: Weigh 5 grams of Salacca zalacca fruit skin ethanol extract and other formulation ingredients according to calculation. Add sodium benzoate crushed with distilled water until homogenized, then add the ethanol extract, glycerin and sorbitol. Then, complete the volume with distilled water. Filter the solution using Whatman paper to obtain a precise result. Add peppermint oil as desired for aroma, then pack it in a container.
2. Formula 2: Weigh 10 grams of Salacca zalacca fruit skin ethanol extract and other formulation ingredients according to calculation. Add sodium benzoate crushed with distilled water until homogenized, then add the ethanol extract, glycerin and sorbitol. Then, complete the volume with distilled water. Filter the solution using

Whatman paper to obtain a clear result. Add peppermint oil as desired for aroma, then pack it in a container.

3. Formula 3: Weigh 15 grams of Salacca zalacca fruit skin ethanol extract and other formulation ingredients according to calculation. Add sodium benzoate crushed with distilled water until homogenized, then add the ethanol extract, glycerin and sorbitol. Then, complete the volume with distilled water. Filter the solution using Whatman paper to obtain a clear result. Add peppermint oil as desired for aroma, then pack it in a container.

For the negative control, sodium benzoate is crushed with distilled water until homogenized and then add glycerin and sorbitol. Without adding active ingredients, it is then filled with distilled water.

E. Testing Procedure

There are some procedures for testing the Salacca zalacca fruit skin extract mouthwash preparation.

1. Organoleptic test. The organoleptic test covers colour, shape, aroma, and taste examinations.
2. pH test. The pH test is conducted using a pH meter. The pH meter is usually soaked in the mouthwash for several minutes, then adjusted according to the indicator's colour on the pH paper and the neutral mouth pH of 5-6.
3. Specific density test. The specific density of the sample is determined using a pycnometer. At room temperature, weigh a clean and dry pycnometer (A g). Then fill it with water and weigh it again (A1 g). Remove the water from the pycnometer and clean it. Fill the sample (mouthwash) into the pycnometer and weigh (A2 g). The specific density of the mouthwash can be measured by the following calculation:

$$\text{Density } (\rho) = \frac{A2-A}{A1-A} \text{ x } \rho.\text{ water (1 g/mL)} \quad (1)$$

4. Viscosity test. The viscosity measurement is performed using a Brookfield viscometer with spindle number 1. The test sample is prepared, the spindle is dipped into the sample, and viscosity testing is performed at 60 rpm. The viscosity value for commercially available mouthwash is ±7.25 mPa s/cps [3].
5. Clarity test. Typically, mouthwash is clear, but there are also thick mouthwashes that must be diluted first. This clarity test is done by observing the mouthwash solution with the naked eye.
6. Cycling test. The mouthwash solution is stored at 4°C for 24 hours and then removed and placed at 40°C for 24 hours. The time during storage of the two

temperatures is considered one cycle. The experiment is repeated in six cycles, and changes in physical appearance are observed and compared before and after testing, which consists of the organoleptic test, pH, specific density, viscosity, and clarity test.

7. Hedonic test. The response received was a hedonic test (liking) on mouthwash with three different concentrations and one without extract in the formulation of mouthwash extract from salak fruit skin. This hedonic test of the respondents was carried out to determine the panellist's liking for colour, aroma, taste, and clarity. The hedonic scale used is 1 - 4, where 1 (very dislike), 2 (dislike), 3 (like), and 4 (very like).

Results

A. Extraction of Salak Fruit Peel (Salacca zalacca)

Table 2 shows the yield result from dry sample to extract wegiht.

Table 2. Percentage of yield

Solvent Type	Dry Sample Weight	Extract Weight	Render
Ethanol 96%	800 g	137.43 g	17.17

Table 3 shows the organoleptic test before and after cycling tets including smell, form, colour and flavour.

Table 3. The organoleptic test

Mouthwash sample	**Before Cycling Test**				**After Cycling Test**			
	Smell	Form	Colour	Flavour	Smell	Form	Colour	Flavour
K-	Mint	Solution	Clear white	Mint, sweet, fresh	Mint	Solution	Clear white	Mint, sweet, fresh
F1	Mint, slight smell of extract	Solution	Clear brown	Mint, sweet, fresh	Mint, a typical extract	Solution	Clear brown	Mint, sweet, fresh
F2	Mint, slight smell of extract	Solution	Chocolate	Mint, sweet, fresh	Mint, a typical extract	Solution	Chocolate	Mint, sweet, fresh
F3	Mint, slight smell of extract	Solution	Dark chocolate	Mint, sweet, fresh	Mint, a typical extract	Solution	Dark chocolate	Mint, sweet, fresh

Remark:

K- = Mouthwash formula without active substance
F1 = Mouthwash formula containing an active ingredient concentration of 5%
F2 = mouthwash formula containing an active ingredient concentration of 10%
F3 = formula mouthwash with an active ingredient concentration of 15%

Table 4 shows the organoleptic test before and after cycling tets including smell, form, colour and flavour. It shows no difference between both.

Table 4. The pH

Mouth wash formula	Before cycling test	After cycling test	pH requirements	Significant
K-	6.3	6.2	5.0 – 7.0	0.098 > 0.05
F1	5.8	5.6		
F2	5.5	5.4		
F3	5.6	5.1		

if P> 0.05, then it is declared stable; if P <0.05, then it is declared unstable

Table 5 shows shows no difference density test before and after cycling tets. Table 6 shows the same finding.

Table 5. The specific density

Wash formula	Before cycling test (g/ml)	After cycling test (g/ml)	Specific density requirements	Significant
K-	1.00	0.97	0.99718 grams or not less than 1	0.166 > 0.05
F1	1.00	0.99		
F2	1.01	1.00		
F3	1.00	1.00		

if P> 0.05, then declare stable; if P <0.05, then declare unstable

Table 6. The viscosity

Wash formula	Before cycling test	After cycling test	Viscosity Requirements	Significant
K-	4.00 mPa's	4.00 mPa's	± 7.25 mPa's	0.070 > 0.05
F1	3.00 mPa's	4.60 mPa's		
F2	3.60 mPa's	4.60 mPa's		
F3	4.00 mPa's	5.70 mPa's		

if P> 0.05, then declare stable; if P <0.05, then declare unstable

Table 7 shows that the clarity is same before and after cycling test.

Table 7. The clarity

Wash formula	Clarity	
	Before cycling test	After cycling test
K-	Clear	Clear
F1	Clear	Clear
F2	Clear	Clear
F3	Clear	Clear

B. The hedonic test evaluation

Fig. 1 shows the hedonic test including colour, aroma, flavour and clarity for K-, F1, F2, and F3.

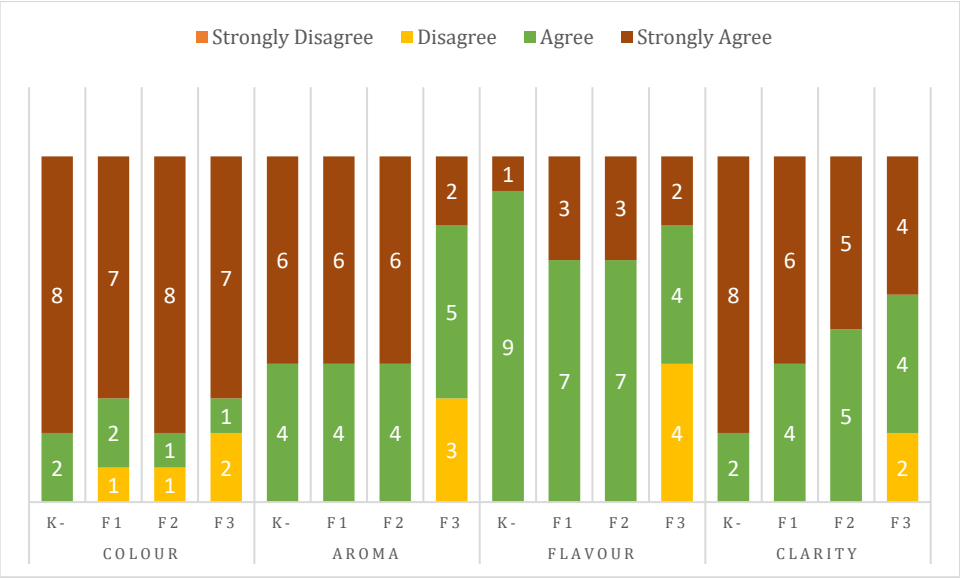


Fig. 1. The hedonic test

Discussion

The study used the skin of salak fruit (Salacca zalacca) as the sample. The study created mouthwash in 3 different concentrations: 5%, 10% and 15%. The basic formula of mouthwash used in the study consisted of sodium benzoate, glycerin, sorbitol, peppermint oil and distilled water to dissolve and make up the desired volume. Glycerin was used in the mouthwash as a humectant to prevent the active ingredients from evaporating and improve the water's stability in the preparation. Sorbitol was used as a sweetener to mask unpleasant bitter tastes and to give the preparation a sweet taste. Peppermint oil was used for its fresh and slightly spicy taste and aroma, which enhances the sensation in the mouth when using the mouthwash [6].

The study continued with the evaluation of the preparation to determine the physical stability of the salak fruit skin extract mouthwash and then tested the antibacterial activity of the formula against Streptococcus mutans. The preparation evaluation included organoleptic tests, pH measurements, density measurements, viscosity measurements, clarity tests, and cycling tests. The preparation evaluation was done with an organoleptic test on the mouthwash preparation. The preparation was placed at 40^{o}C and 4^{o}C temperatures. The cycling test was performed on the preparation with different storage temperatures at specific intervals to accelerate the changes that usually occur under normal conditions. The stability test of the drug or preparation must be done to determine a product's ability to maintain its properties and characteristics so that it remains the same after preparation and throughout the storage period [7]. This test aims to determine the stability of preparation, and at this stage, the organoleptic

test (colour, aroma, and form) is carried out. It is expected that the preparation, both before and after the cycling test, will not experience any changes in colour, aroma and form. The results of the organoleptic test of the four preparations made in table 3 show no change in colour, aroma, and form before and after storage.

The next test was the pH test on the mouthwash preparation. The results of the pH test showed that the four mouthwash preparations that were made experienced a change in pH after the cycling test. In preparation K-, F1, F2, and F3, the pH decreased but remained within the specified range of 5-7, which is the standard pH of mouthwash. The change in pH can be caused by several factors, such as temperature, storage, and sensitivity of the pH meter used [8]. The addition of the extract affected the change because the extract contained compounds, causing the pH of the mouthwash preparation to decrease after the cycling test. Based on the pH test results, the paired sample T-test was analyzed and showed a result of $p>0.05$, which means that there was no significant difference between the concentrations and pH of each data before and after the cycling test and was declared stable.

The next test was the density test on the mouthwash preparation. The results showed that the density of the four mouthwash preparations did not change after the cycling test and remained within the normal range. This indicates that the addition of the salak fruit skin extract did not affect the density of the mouthwash preparation.

Finally, the antibacterial activity of the mouthwash preparation was tested against Streptococcus mutans. The results showed that the antibacterial activity of the mouthwash preparation increased with increasing concentration. The highest antibacterial activity was found in the preparation F3 with a concentration of 15%.

The following references are studies on the formulation of mouthwash solutions and their effectiveness in preventing plaque accumulation and inhibiting bacteria growth. Ref. [9] investigated the formulation of mouthwash solution using pineapple skin extract. Ref. [10] evaluated the efficacy of morinda fruit extract mouthwash in reducing plaque accumulation among dental students. Ref. [11] studied the characteristics and antibacterial activity of a mouthwash solution based on the combination of turmeric and kaffir lime leaves extract. Ref. [12] investigated the usage of mouthwash among students from various faculties at the University of Sumatera Utara. Ref. [13] formulated mouthwash using jarak pagar leaf extract and evaluated its physical stability. Ref. [14] formulated and tested the antibacterial activity of a mouthwash solution based on beluntas leaf extract against Streptococcus mutans. This study shows that there are various plant and fruit potentials in Indonesia for plaque-removing mouthwash.

The studies by Ref. [15-17] demonstrate the diversity and potential of the Salak fruit (Salacca zalacca) in Indonesia. Ref. [15] analyzed the morphological and anatomical differences

of the red variety of Salak in the Enrekang district. Ref. [16] tested the antimicrobial efficacy of Salak Pondoh skin extract against Pseudomonas aeruginosa in vitro. Meanwhile, Ref. [17] investigated the relationship between the vegetative and generative morphologies of Salak Pondoh in the Salak Pondoh center in the Malang district. These studies suggest that Salak has a wide range of applications, including as a potential source for antimicrobial agents.

Conclusion

The study concludes that the skin of the salak fruit (Salacca zalacca) can create a mouthwash with stable physical properties. The physical stability of the mouthwash was tested through various evaluations, including organoleptic, pH, specific density, viscosity, clarity, and cycling tests. The results showed no significant changes in the appearance, aroma, or form of the mouthwash after storage. However, the pH levels of the mouthwash decreased slightly but remained within the standard range for mouthwash (5-7). The results of the antibacterial activity tests against Streptococcus mutans showed that the concentration of the salak skin extract in the mouthwash positively impacted the antibacterial activity. Overall, the study found that the salak skin extract mouthwash had the potential as a natural alternative to commercial mouthwash.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

[1] Anastasia, A., Yuliet, Y., & Tandah, M. R. (2017). Formulasi Sediaan Mouthwash Pencegah Plak Gigi Ekstrak Biji Kakao (Theobroma Cacao L.) Dan Uji Efektivitas Pada Bakteri Streptococcus Mutans: Mouthwash Formulation Of Tooth Plaque Preventing Of Kakao (Theobroma Cacao L.) Seed Extract And Effectivity Test On. *Jurnal Farmasi Galenika (Galenika Journal Of Pharmacy), 3*(1), 84–92.

[2] Egi, M., Soegiharto, G. S., & Evacuasiany, E. (2019). Efek Berkumur Sari Buah Tomat (Solanum lycopersicum L.) Terhadap Indeks Plak Gigi. *SONDE (Sound Of Dentistry), 3*(2), 70–84.

[3] Noval, N., Melviani, M., Novia, N., & Syahrina, D. (2020). Formulasi Dan Evaluasi Sediaan Obat Kumur (Mouthwash) Dari Ekstrak Etanol Tanaman Bundung (Actinoscirpus Grossus) Sebagai Antiseptik Mulut. *Jurnal Surya Medika, 6*(1), 112–120.

[4] Kono, S. R., Yamlean, P. V. Y., & Sudewi, S. (2018). Formulasi Sediaan Obat Kumur Herba Patikan Kebo (Euphorbia Hirta) Dan Uji Antibakteri Prophyromonas Gingivalis. *Pharmacon, 7*(1), 37–46.

[5] Shabir, E. S., Rahmadani, A., Meylina, L., & Kuncoro, H. (2018). Uji Fitokimia Ekstrak Kulit Buah Salak (Salacca zalacca) Dan Pengaruh Ekstrak Terhadap Pertumbuhan Bakteri Streptococcus Mutans Dan Jamur Candida Albicans. *Proceeding Of Mulawarman Pharmaceuticals Conferences*, (8 November), 314–320.

[6] Pane, M. (2019). *Formulasi Sediaan Obat Kumur Ekstrak Teh Hijau (Camellia Sinensis (L.) Kuntze)*. Univ Sumatera Utara, 1.

[7] Suryani. (2017). Formulasi Dan Uji Stabilitas Sediaan Gel Ekstrak Terpurifikasi Daun Paliasa (Kleinhovia hospita L.) Yang Berefek Antioksidan. *Pharmaconjurnal Ilmiah Farmasi*, *6*(3), 157-169.

[8] Rasyadi, Y. (2018). Formulasi Sediaan Kumur Dari Ekstrak Daun Sukun Artocarpus Altilis

[9] Baitariza, A., Ghazali, A., & Rosmiati. (2020). Formulasi Larutan Obat Kumur Pencegah Plak Gigi Ekstrak Kulit Nanas (Ananas Comosus L. Merr). *Jurnal Sabdariffarma, 6*(1), 33–42.

[10] Kasuma, N., Fajrin, F. N., Aldi, Y., & Fitri, H. (2016). Pengaruh obat kumur ekstrak morinda citrifolia l. sebagai antigingivitis. *Dentika Dental Jounal*, *19*(2), 102-109.

[11] Munawar, F. (2021). *Karakteristik dan aktivitas antibakteri larutan kumur berbahan dasar ekstrak kombinasi daun kunyit (curcuma longa linn.) dan daun jeruk purut (citrus hystrix)* (Doctoral dissertation, UIN Mataram).

[12] Saputri, O. E. (2018). *Pemakaian Obat Kumur Pada Mahasiswa Fakultas Kedokteran Gigi, Fakultas Teknik Dan Fakultas Ilmu Budaya Di Universitas Sumatera Utara* (Doctoral dissertation, Universitas Sumatera Utara).

[13] Rahma, A. G. (2019). Formulasi Sediaan Obat Kumur Ekstrak Daun Jarak Pagar (Jatropha Curcas L.) Dan Uji Kestabilan Fisiknya. *Karya Tulis Ilmiah D III Kesehatan. Poltekkes Kemenkes Palembang. Jurusan Farmasi*, 5-10.

[14] Sarifuddin. (2021). Formulasi Dan Uji Aktivitas Antibakteri Mouthwash Ekstrak Daun Beluntas (Pluchea Indica Less) Terhadap Streptococcus mutans. *Biolearning journal, 9*(1), 9-12.

[15] Darmawati, D. (2019). *Analisis Keragaman Salak (Salacca Zalacca) Varietas Merah Berdasarkan Morfologi dan Anatomi Di Kabupaten Enrekang* (Doctoral dissertation, Universitas Islam Negeri Alauddin Makassar).

[16] Demasari, A. P. (2018). *Uji Efektivitas Ekstrak Kulit Salak Pondoh (Salacca zalacca) sebagai Antimikroba terhadap Pseudomonas aeruginosa secara In Vitro* (Doctoral dissertation, Universitas Brawijaya).

[17] Nugroho, Y. A., & Ningsih, E. M. N. (2020). Hubungan Morfologi Vegetatif Dan Generatif Salak Pondoh (Salacca Zalacca) Di Sentra Salak Pondoh Kabupaten Malang. *Agrika*, *14*(2), 172-183.

Authors



Nasrawati Basir is an education scientist, lecturer of Pharmacy Study Program, Faculty of Pharmacy, Megarezky Universitiy Makassar, Indonesia. Her bachelor from Universitas Islam Negeri Alauddin Makassar and master degree were graduated from Universitas Hasanuddin, Indonesia. Her research interset is in the post incidence therapy and active in an profesional association. (email: nasrawatibasir@unimerz.ac.id).



Nurfiddin Farid is a lecturer at Pharmacy Department, Faculty of Pharmacy Megarezky University Makassar, Indonesia. Him specialization is microbiology. He has published many articles in pathogenic bacteria (email: ojhy.kojhyro@unimerz.co.id).



Sriyanty Sadsyam is a lecturer at at Pharmacy Department, Faculty of Pharmacy Megarezky University Makassar, Indonesia. Her bachelor is from Universitas Islam Negeri Alauddin Makassar, master and professional education from Universitas Hasanuddin Makassar, Indonesia (Email: Sriyantisadsyam@unimerz.ac.id).



Andi Ulfiana Utari is a lecturer at at Pharmacy Department, Faculty of Pharmacy Megarezky University Makassar, Indonesia. Her degree is from Universitas Islam Negeri Alauddin Makassar for bachelor degree and Universitas Hasanuddin Makassar, Indonesia (email: andiulfianautari@unimerz.ac.id).



Andi Bibit Utari Rahayu is a student of the Pharmacy Study Program, Faculty of Pharmacy, Megarezky University Makassar, Jalan Antang Raya No.4, Makassar 90234, Indonesia. (email: utarirahayuandibibit@gmail.com).