Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Effectiveness Test Of Face Wash Gel Kersen Leaf (*Muntingia Calabura*) Thick Extract As Anti-Acne Agent

Novena Adi Yuhara
Faculty of Pharmacy, Immanuel Christian University, Solo Street 11,1 Kalasan, Sleman, Indonesia

Article Info
Keywords:
Face wash gel,
Staphyloccus aureus,
Acne vulgari,
Muntingia calabura

ABSTRACT
Acne Vulgaris or acne is a skin disease caused by a blockage in the pores of the skin that causes oil secretion to be inhibited which will increasingly enlarge and experience inflammation and bacterial activity. One of the bacteria that can trigger acne is Stapyloccus aureus. Kersen plant is one of the plants that have properties as antibacterial. face wash gel is a facial cleanser with a gel base that contains foam, usually used for sensitive, oily and acne skin. Investigating the antibacterial properties of the Kersen plant may offer a potential treatment strategy. Additionally, the physical tests of gel-based face washe warrant further exploration. The purpose of this study was to see the effect of carbopol on the preparation and also to see the concentration of kersen leaf extract that can inhibit S.aureus bacteria. Preparation was done by dissolving kersen leaf extract with ethanol. Then in a separate place, Carbopol was developed with warm water (40-50°C) until it expanded. Then in a glass beaker dissolved propyl paraben, methyl paraben and SLS with distilled water and added Carbopol that has expanded stir until homogeneous and formed a gel base. Then Kersen leaf extract was added and stirred until homogeneous and TEA was added little by little along with stirring until homogeneous. Physical tests were carried out including organoleptic tests by observing the aroma, color and shape, testing the pH of the preparation with universal pH paper, testing the foam height of the preparation, testing the viscosity with a Brookfield viscometer, testing homogeneity and conducting bacterial activity tests with the paper disk method. The results obtained by the preparation of face wash gel of kersen leaf extract with F0-F2 obtained preparations that have a cloudy, light brown and dark brown color. It has a kersen smell with the addition of kersen and its texture from liquid to thick. The preparation has a pH of 7 and is homogeneous, has a viscosity that meet the requirements. The foam height of the preparation is in the range of 8.9 cm - 9.2 cm, which meets the requirements. In the activity test results, it was found that F2 with an extract concentration of 0.5 g had a better inhibition zone of 60 mm.

Corresponding Author:
Novena Adi Yuhara
Immanuel Christian University
Solo Street 11,1 Kalasan
novena@ukrimuniversity.ac.id

INTRODUCTION

Acne Vulgaris or acne is a skin disease caused by a blockage in the pores of the skin which causes oil secretion to be inhibited which will increasingly enlarge and experience

Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

inflammation and bacterial activity (Melly Nirmala et al., 2021). One of the bacteria that can trigger acne is Stapyloccus aureus (Lestari et al., 2021). Stapyloccus aureus is a normal flora found on the skin, which can cause acne by damaging the startum corneum and stratum germativum by releasing chemicals that destroy the walls of the skin pores. Acne usually occurs in adolescence due to an increase in estrogen and progesterone hormones which can cause increased production of oil and sweat glands which can cause acne. The rate of acne in adolescents aged 15 - 18 years is 80 - 85%, women over 25 years of age by 12% and 35 - 44 years of age by 3% (Madelina & Sulistiyaningsih, 2018). The presence of acne needs care and treatment.

Treatment of acne usually uses antibiotics both topically and orally such as clindamycin. However, continuous use of antibiotics will cause bacterial resistance so that other alternatives are needed, namely the use of herbal plants (Asriani Safitri et al., 2021). Kersen plant (*Muntingia calabura L.*) is a plant that has antibacterial activity. Based on the antibacterial activity test of kersen leaf extract conducted by the Staphylococcus aureus bacteria that causes acne, the KBM value is 0.25 mg/mL (Feronica Manik et al., 2014). This study is investigating the antibacterial properties of the Kersen plant may offer a potential treatment strategy, as one of the efforts to utilize herbal plants and reduce antibiotic resistance. Antibacterial activity test of kersen leaf extract made in face wash gel preparations against Staphylococcus aureus bacteria. Additionally, the physical tests of gel-based face washe warrant further exploration. Face wash gel preparation is a facial cleanser with a gel base containing foam, usually used for sensitive, oily and acne skin. This preparation has a soft texture and is easily absorbed on the skin (S. H. Annisa, 2018). So this study was conducted to see the effect of carbopol on the making of appropriate facewash preparations and also to see the concentration of kersen leaf extract that can inhibit S.aureus bacteria.

METHODS

The tools and materials used in the research "making Face Wash Gel Anti-Acne Preparations" are mortar, stamper, Bunsen, three legs, porcelain cup, test tube, measuring cup, analytical balance, Brookfield viscometer, drop pipette, porcelain cup, watch glass, micropipette, ose needle, Erlenmeyer, stirring rod, spatula, parchment paper, paper disk, sudip and tweezers. The materials used are ethanol extract of kersen leaves, Carbopol, methyl paraben, propyl paraben, TEA, SLS, propylenglycol, distilled water, SDA, NB and Staphylococcus aureus bacterial suspensions.

Preparation was carried out by dissolving kersen leaf extract with ethanol little by little until completely dissolved. Then in a separate place, Carbopol was developed with warm water (40-50°C) until it expanded. Then in a glass beaker dissolved propyl paraben, methyl paraben and SLS with distilled water and added Carbopol that has expanded stir until homogeneous and formed a gel base. Then the kersen leaf extract was added and stirred until homogeneous and TEA was added little by little along with stirring until homogeneous [8]. The formula can see at table 1.

Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Table 1. Kersen leaf extract face wash gel

Materials	F0 (g)	F1 (g)	F2 (g)	Function
Kersen leaf extarct	-	0,2	0,5	Active substance
Carbopol	0,25	0,50	0,75	Gelling agent
Methylparaben	0,0375	0,0375	0,0375	Preservatives
Propylparaben	0,0125	0,0125	0,0125	Preservatives
TEA	2,5	2,5	2,5	Thickener
Propylenglycol	2,5	2,5	2,5	Solvent
SLS	1	1	1	Defoamer
Aquadest	Ad 50	Ad 50	Ad 50	Solvent

The preparation evaluation test includes organoleptic test, homogeneity test, pH test, foam height test, viscosity test. Organoleptical Test. Changes in shape, color, odor and texture of the face wash gel preparation of kersen leaf extract were carried out using the five senses (Ayunda & Rosalina, 2023). Homogeneity Test. Applied face wash gel preparation on transparent glass, Homogeneity is indicated by the absence of coarse grains. pH test. Testing the pH of the face wash gel preparation was measured using a universal pH stick dipped in the preparation, allowed to stand for a while and the results were adjusted to the universal pH standard (Sri, 2017). Foam height test. Face wash gel preparation is taken 2 ml, put in a test tube and added with distilled water and shaken the tube 10 times and observed the height of the foam formed (Rinaldi et al., 2021). Viscosity Test. Put the face wash gel preparation in a glass beaker, placed the rotor in the center, turned on so that the rotor rotates and read the viscosity results on the scale (Genatrika et al., 2016).

Antibacterial activity test using disc paper method. Media Preparation. Nutrient agar media (NA) was made by putting 2.3 g of NA media into an erlenmeyer and then dissolved by adding 100 ml of distilled water, then heated to boiling on a hot plate while homogenized (Angelina, M. et al., 2015)Antibacterial activity test Face wash gel Kersen leaf extract. The antibacterial activity test was carried out with the aim of knowing the ability of the face wash gel preparation to inhibit the growth of acne-causing bacteria, namely Staphylococcus aureus. This test was carried out by means of NA media put into a Petri dish as much as 20 ml and then mixed with 1 ml of bacterial suspension, then allowed to solidify. paper discs were prepared and inserted into each preparation and then placed on a Petri dish containing sodium agar and incubated for 1x24 hours (Andini et al., 2020). Zone of inhibition formation was measured using a caliper with mm units.

RESULTS AND DISCUSSION

Preparation of Kersen Leaf Extract Face Wash Gel

In the preparation of face wash gel Kersen leaf extract is done with variations in carpobol concentration to see the concentration that can produce a good face wash gel preparation and also variations in the concentration of Kersen leaf extract to determine which concentration has inhibitory activity against acne-causing bacteria. Preparation is made by expanding carbopol which functions as a gelling agent using hot water until it expands completely and is crushed to form a gel base(Auliya Zulfa et al., 2023). Selection of Carbopol as a gelling agent because it can form a good gel and can increase the viscosity of the

Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

preparation. Furthermore, methyl paraben and propyl paraben are mixed which function as preservatives with sodium lauryl sulfate (SLS) which functions as a foam-producing surfactant with distilled water until homogeneous. The choice of methyl paraben and propyl paraben as preservatives is because these two preservatives have the most effective action in all dosage formulas. The use of SLS in this preparation is also because it is a cleansing surfactant that produces preparations with good physical stability. Then the mixture of methyl, propyl paraben and SLS was mixed with the gel base, then Kersen leaf extract was added and finally TEA was slowly added to anticipate the gel base would not break. TEA which functions to increase the viscosity of the preparation (Melly Nirmala et al., 2021).

Organoleptic Test

The purpose of the organoleptical test on this preparation is to determine the smell, color and shape of the preparation that has been made (Salman et al. 2023). Based on the results of the research that has been done, it is obtained that the color of the face wash gel preparation from F0 - F2 is influenced by kersen leaf extract. This can be seen from the color of F0 cloudy with the color according to the base because there is no addition of kersen extract, while in F1 and F2 the color is light brown and dark brown due to the addition of extracts to the preparation. The dosage form F0 -F2 was found to have an increase in viscosity with the addition of Carbopol concentration in the formula, namely 0.25 g; 0.50 g and 0.75 g. In the observation of aroma, F0 was found to be odorless while F1 and F2 smelled of kersen. This is due to the addition of kersen leaf extract in F1 and F2 while F0 does not use kersen leaf extract. The result of organoleptis test showed at Table 2.

Table 2. Organoleptis test

	color	form	smell
F0	Cloudy	liquid	Odorless
F1	Light brown	Slightly thick	Smells of kersen
F2	Brown	Thicken	Smells of kersen

Organoleptical results depend on the components of the gel preparation ingredients. The color of the gel is influenced by the herbs used. In the study using dragon fruit produced a brownish purple color (Yuniarsih et al., 2021). The color of the blank face wash gel formulation is white, and the color intensity increases with the addition of Thai herbal extracts - the microemulsion system itself is brownish yellow. This may be due to the brownish yellow color of the Thai herbal extract combined with the microemulsion system itself. (Kajornwongwattana W & Suksaeree J, 2016). Likewise, the aroma and form will adjust to the herbs used. The preparation is purple-brown has a characteristic aromatic odor, and takes the form of a gel (Yuniarsih et al., 2021).

Homogeneity Test

Homogeneity testing aims to see whether all the ingredients in the formula are homogeneously mixed or not. The requirement for a homogeneous test is that there are no visible coarse grains and bubbles in the preparation (Jumardin et al., 2023). Based on the results obtained, the preparations F0, F1, and F2 are homogeneous because when making the gel base preparation (Carbopol) expands completely so that when crushed there are no

Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

granules - lumps of Carbopol. In addition, there are also no bubbles when testing the preparation. This is because during the homogeneity test, the foam in the preparation has been allowed to stand for a while so that it has shrunk completely. The result of homogeneity test showed at Table 3.

Table 3. Homogeneity test

	Description
F0	Homogeneous
F1	Homogeneous
F2	Homogeneous

The other study, it was homogenously mixed in face wash gel formulation containing thai herbal extract (Kajornwongwattana W & Suksaeree J, 2016).

pH Test

pH testing is done to determine the level of acidity and alkaline of the face wash gel preparation so as not to cause irritation when applied to the face. The pH requirement for face wash gel preparations is 4.5 - 6.5 in accordance with the pH of the skin. If the preparation is too alkaline it will cause scaly skin while if it is too acidic it will cause irritation to the skin (Jumardin et al., 2023). Based on the tests carried out, it was found that F0 - F2 had the same pH, namely 7. This is influenced by the addition of SLS which has a pH of 6-9 in the preparation (Khairunnisa et al., 2023). The result of pH test showed at Table 4.

Table 4. pH test

	Description
F0	7
F1	7
F2	7

Other study showed that the Herbal Face Wash Gel, Soap and Shampoos were acid balanced and were ranged 5.6 to 7.0, which is near to the skin pH(Joshi et al., 2019).

Foam Height Test

Testing the foam height on this face wash gel aims to determine whether the surfactant used in the preparation can produce good foam or not. In face wash preparations there is no requirement for maximum and minimum foam height of the preparation (Yuniarsih et al., 2020). Based on the results obtained F0 - F2 has a foam height that is close together, namely 9 cm; 9.2 cm and 8.9 cm. This is influenced by the surfactant Sodium lauryl sulfate which is the same amount in each formula. The result of foam height test showed at Table 5.

Table 5. foam height test

	Description (cm)
F0	9
F1	9,2
F2	8,9

The increase and decrease in foam power values is due to the shaking method during foam power testing using manual methods, not using a tool that has a standard speed and

Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

time that can be adjusted as needed, for example, such as a magnetic stirrer (Yuniarsih et al., 2021).

Viscosity Test

Viscosity testing of face wash gel preparations aims to see or know the consistency produced from the preparation is stable or not so that it can affect the use of preparations such as being easier to remove from the container and not easily flowing on the hands (Nurul Fauziyah & Widyasanti, 2021). The test was carried out by inserting the shampoo preparation in a glass beaker, placing the rotor in the center, turning it on so that the rotor was blind and reading the viscosity results on the scale, the speed used was 12 rpm with no rotor 2. The viscosity requirement of the face wash is 400 - 4000 mpa/s (Yuniarsih et al., 2020). Based on the tests that have been carried out on F0-F2, it is found that there is an increase in the viscosity of the preparation with the addition of carpobol concentrations, namely 0.25; 0.50 and 0.75. So it can be concluded that the viscosity of this face wash gel is influenced by carpobol. The optimal viscosity results are found in the F1 preparation was shown at table 6.

Table 6. Viscosity test

	Description (mpa/s)
F0	undefined
F1	230
F2	over

The other result, gel viscosity shows that the higher the carbomer concentration, the higher the viscosity of the gel (F1= 1624cP; F2=1480cP; F3=over). Carbomer variation causes differences in viscosity values (F1=0,5%; F2=0,7%; F3=2,0%) (Wulandini et al., 2019).

Antibacterial Activity Test

The antibacterial activity test aims to determine the ability of face wash gel preparations to inhibit the growth of acne-causing bacteria, namely Staphylococcus aureus. This test is carried out by means of NA media put into a Petri dish as much as 20 ml and then mixed with 1 ml of bacterial suspension, then allowed to solidify. paper discs are prepared and inserted into each preparation and then placed on a Petri dish containing sodium agar and incubated for 1x24 hours in order to get good inhibition of face wash gel kersen leaf extract (Rasyadi et al., 2019).

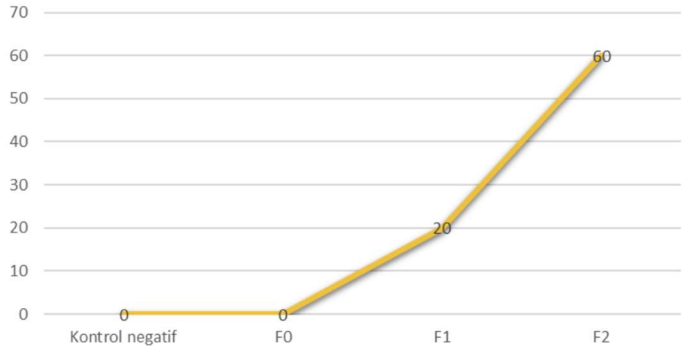

Figure 1. The results of the antibacterial activity

Jurnal Eduhealth
Volume 15 , Number 04, 2024, DOI 10.54209/eduhealth.v15i04
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

The results of the antibacterial activity test showed a zone of inhibition against S. aureus which became wider as the concentration of the extract increased as shown at figure 1. Based on the tests that have been carried out, it is found that in the negative control (aquadest) there is no inhibition zone, in F0 there is also no inhibition because the active substance (kersen leaf extract) is not given, in F1 the inhibition zone of *S. aureus bacteria* is 20 mm with an extract content of 0.2 g, while in F2 there is an inhibition zone of 6 mm. So it can be concluded that the best antibacterial activity is the F2 preparation with 0.5g extract concentration. The result of bacterial inhibition activity test showed at table 7.

Table 7. Bacterial inhibition activity test

	Description (mm)
F0	-
F1	20
F2	60

The study showed poly herbal (grape, cucumber, and orange) were taken for testing the anti microbial activity against three different microorganisms i.e Staphylococcus aureus, S. epidermidis and Propionibacterium acnes had zone of inhibition. Staphylococcus aureus inhibited by poly herbal with/without honey (F1 =10mm; F2=6mm; F3=6mm)(Mamatha et al., 2022). This zone more narrow than Karsen Leaf as single herbal with less concentrate. Therefore, the results of the present study are better in the inhibition of Staphylococcus aureus.

CONCLUSION

Based on the research that has been done on the manufacture and testing of face wash gel preparations of kersen leaf extract and effect of carbopol on the preparation. The preparations are obtained that have a cloudy (F0), light brown (F1) and dark brown color (F2). It has a kersen smell with the addition of kersen (F0-F2) and its texture from liquid to thick (F0-F2). The preparation has a pH of 7 and is homogeneous (F0-F2), has an optimal viscosity at F1. The foam height of the preparation is 9, 9.2, 8.9 cm (F0-F2), which meets the requirements. Carbopol variation causes differences in viscosity values. In the activity test results, it was found that F2 with an extract concentration of 0.5 g had the widest inhibition zone of 60 mm. In this study, no stability test was carried out to see the durability and stability of the preparation, so it needs to be developed with an optimal formula that can inhibit microbes in a stable preparation.

REFERENCE

Andini, D., Mulangsri, K., & Zulfa, E. (2020). Uji Aktivitas Antibakteri Ekstrak Terpurifikasi Daun Mangga Arumanis (Mangifera indica L.) dan Identifikasi Flavonoid dengan KLT: *Jurnal Farmasi Galenika (Galenika Journal of Pharmacy) (e-Journal)*, *6*(1), 55–62. https://doi.org/10.22487/J24428744.2020.V6.I1.14044

Asriani Safitri, E., Fatmawati, A., & Ilmu-Ilmu Kesehatan, F. (2021). PHARMACEUTICAL JOURNAL OF INDONESIA Aktivitas Inhibisi Ekstrak Etanolik Ulva lactuca terhadap

Bakteri Staphylococcus aureus. In *PHARMACEUTICAL JOURNAL OF INDONESIA 2021* (Vol. 7, Issue 1). http://.pji.ub.ac.id

Auliya Zulfa, A., Yuniarsih, N., Faomasi Gulo, A., Fathurrohmah, A., Amirulloh, N., & Salma Dhaniaty, S. (2023). Literature Review Article : Sabun Muka Tomat (Solanum Lycopersicum) Sebagai Antioksidan. *Jurnal Multidisiplin Indonesia*, *2*(6), 904–910. https://doi.org/10.58344/JMI.V2I6.239

Ayunda, M., & Rosalina, L. (2023). Kelayakan Sediaan Sampo Daun Jarak Pagar (Jatropha Curcas L.) untuk Perawatan Rambut. *Jurnal Pendidikan Tambusai*, *7*(2), 15927–15937. https://doi.org/10.31004/JPTAM.V7I2.8888

Feronica Manik, D., Hertiani, T., Anshory, H., & Mada, G. (n.d.). *ANALISIS KORELASI ANTARA KADAR FLAVONOID DENGAN AKTIVITAS ANTIBAKTERI EKSTRAK ETANOL DAN FRAKSI-FRAKSI DAUN KERSEN (Muntingia calabura L.) TERHADAP Staphylococcus aureus*.

Genatrika, E., Nurkhikmah, I., & Hapsari, I. (2016). FORMULASI SEDIAAN KRIM MINYAK JINTAN HITAM (Nigella sativa L.) SEBAGAI ANTIJERAWAT TERHADAP BAKTERI Propionibacterium acnes. *PHARMACY: Jurnal Farmasi Indonesia (Pharmaceutical Journal of Indonesia)*, *13*(02), 192–201. https://doi.org/10.30595/PJI.V13I02.1256

Joshi, J., Bhandari, D. P., Ranjitkar, R., Bhandari, L., & Yadav, P. M. (2019). Formulation and Evaluation of Herbal Soap, Shampoo and Face Wash Gel. In *Journal of Plant Resources* (Vol. 17, Issue 1).

Jumardin, W., Firdaus, S., & Utari, A. U. (2023). Formulasi dan Uji Aktivitas Antibakteri Sediaan Gel Facial Wash Ekstrak Etanol Daun Belimbing Wuluh (Averrhoa Bilimbi L.) Terhadap Pertumbuhan Propionibacterium Acnes Penyebab Jerawat. *INHEALTH : INDONESIAN HEALTH JOURNAL* , *2*(2), 153~169-153~169. https://doi.org/10.56314/INHEALTH.V2I2.156

Kajornwongwattana W, & Suksaeree J. (2016). Formulation of face wash gel containing Thai herbal extract self-microemulsifying system. In *Thai Journal of Pharmaceutical Sciences (TJPS) Journal homepage* (Vol. 40). http://www.tjps.pharm.chula.ac.th

Khairunnisa, K., Budi, S., & Rohama, R. (2023). Formulasi Dan Uji Stabilitas Fisik Facial Wash Ekstrak Daun Sepat (Mitragyna Speciosa Kroth). *Innovative: Journal Of Social Science Research*, *3*(5), 9832–9841. https://doi.org/10.31004/INNOVATIVE.V3I5.6059

Lestari, R. T., Gifanda, L. Z., Kurniasari, E. L., Harwiningrum, R. P., Kelana, A. P. I., Fauziyah, K., Widyasari, S. L., Tiffany, T., Krisimonika, D. I., Salean, D. D. C., & Priyandani, Y. (2021). PERILAKU MAHASISWA TERKAIT CARA MENGATASI JERAWAT. *Jurnal Farmasi Komunitas*, *8*(1), 15–19. https://doi.org/10.20473/JFK.V8I1.21922

Madelina, W., & Sulistiyaningsih, S. (2018). REVIEW: RESISTENSI ANTIBIOTIK PADA TERAPI PENGOBATAN JERAWAT. *Farmaka*, *16*(2), 105–117. https://doi.org/10.24198/JF.V16I2.17665

Mamatha, D., Kaur, A., Madhu Sri, G., Maneesha, P., & Mounika, P. (2022). Formulation and Evaluation of a Poly Herbal Anti Acne Fruit Face Wash Gel Production and Hosted by Pharmasprings.com. In *Future J. Pharm. Health. Sci* (Vol. 2022, Issue 1). https://pharmasprings.com//jphs

Melly Nirmala, F., Artikel, I., Sediaan Facial Wash Kombinasi Perasan Jeruk Lemon, F., Ayu Rai Saputri, G., & Marcellia, S. (2021). Formulasi Sediaan Facial Wash Kombinasi Perasan Jeruk Lemon (Citrus Limon (L.)) Dan Ekstrak Buah Tomat (Solanum lycopersicum L.) Sebagai Antibakteri Propionibacterium Acnes. *Jurnal Mandala Pharmacon Indonesia*, *7*(2), 188–206. https://doi.org/10.35311/JMPI.V7I2.87

Nurul Fauziyah, R., & Widyasanti, A. (2021). The valorization of neem leaves infused coconut oil at various concentrations for the production of natural liquid shampoo. *Advances in Food Science, Sustainable Agriculture and Agroindustrial Engineering*, *4*(2), 131–137. https://doi.org/10.21776/UB.AFSSAAE.2021.004.02.6

Rasyadi, Y., Yenti, R., & Jasril, A. P. (2019). Formulasi dan Uji Stabilitas Fisik Sabun Mandi Cair Ekstrak Etanol Buah Kapulaga (Amomum compactum Sol. ex Maton). *PHARMACY: Jurnal Farmasi Indonesia (Pharmaceutical Journal of Indonesia)*, *16*(2), 188–198. https://doi.org/10.30595/PHARMACY.V16I2.5675

Rinaldi, Fauziah, & Rizka Mastura. (2021). *FORMULASI DAN UJI DAYA HAMBAT SABUN CAIR EKSTRAK ETANOL SERAI WANGI (Cymbopogon nardus L) TERHADAP PERTUMBUHAN Staplylococcus aureus*.

S. H. Annisa. (2018). *FORMULASI DAN UJI STABILITAS FACE WASH GEL EKSTRAK ETANOL DAUN KERSEN (Muntingia Calabura L) SEBAGAI ANTI JERAWAT*.

Sri, R. D. P. (2017). FORMULASI DAN EVALUASI MUTU FISIK SABUN DARI EKSTRAK RUMPUT LAUT MERAH (Euchema cottoni). *Jurnal Wiyata: Penelitian Sains Dan Kesehatan*, *2*(1), 14–18. https://doi.org/10.56710/WIYATA.V2I1.29

Studi Biologi, P., Mipa, F., Tanjungpura, U., Hadari Nawawi, J. H., Angelina, M., Turnip, M., & Khotimah, S. (2015). *Uji Aktivitas Antibakteri Ekstrak Etanol Daun Kemangi (Ocimum sanctum L.) Terhadap Pertumbuhan Bakteri Escherichia coli dan Staphylococcus aureus* (Vol. 4, Issue 1).

Wulandini, R., Irwansyah, F. S., & Windayani, N. (2019). Formulation of facial cleansing gels using aloe vera as natural surfactant. *Journal of Physics: Conference Series*, *1402*(5). https://doi.org/10.1088/1742-6596/1402/5/055069

Yuniarsih, N., Akbar, F., Lenterani, I., Fakultas Farmasi, F., Buana Perjuangan Karawang, U., & Barat, J. (2020). FORMULASI DAN EVALUASI SIFAT FISIK FACIAL WASH GEL EKSTRAK KULIT BUAH NAGA MERAH (Hylocereus polyrhizus) DENGAN GELLING AGENT CARBOPOL. *Pharma Xplore : Jurnal Sains Dan Ilmu Farmasi*, *5*(2), 57–67. https://doi.org/10.36805/JPX.V5I2.1194

Yuniarsih, N., Lenterani, I., & Farhamzah. (2021). Formulation and Physical Stability Test of Facial Gel Wash Dragon Fruit (hylocereus polyrhizus) Peel Extract. *IOP Conference Series: Materials Science and Engineering*, *1071*(1), 012012. https://doi.org/10.1088/1757-899x/1071/1/012012