JPPIPA 9(11) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Formulation and Activity Test of Red Algae Extract Gel (*Eucheuma cottonii*) Against *Propionibacterium acnes* Bacteria

Nurhikma Awaluddin[1*], Andi Meinar Dwi Rantisari Thayeb[1], Andi Ulfiana Utari[1], Akbar Awaluddin[2], Nur Pebrianti Caronge[1]

[1] Faculty of Pharmacy, Megarezky University, Makassar, Indonesia.
[2] Faculty of Health, Almarisah Madani University, Makassar, Indonesia.

Received: September 29, 2023
Revised: October 5, 2023
Accepted: November 25, 2023
Published: November 30, 2023

Corresponding Author:
Nurhikma Awaluddin
hykma.awaluddin@unimerz.ac.id

DOI: 10.29303/jppipa.v9i11.5513

Abstract: Flavanoids are one of the many compounds in phenols that can denature bacterial cell membrane proteins, thus inhibiting cell growth. The purpose of this study was to formulate an anti-acne gel for the ethanolic extract of red algae (Eucheuma cottonii) and to test its antimicrobial activity against Propionibacterium acnes. The method used is laboratory research design by making antiacne gel preparations of red algae extract with concentrations of 1%, 3%, 5% and testing the antimicrobial activity with the agar diffusion method using wells on MHA media which is incubated for 1x24 hours. The results of the evaluation of the gel preparation before and after the cycling test met the requirements of organoleptic, homogeneity, pH, viscosity, and dispersibility where each formula was stable in the gel preparation. The results showed that red algae extract (Eucheuma cottonii) could be formulated and was stable in the form of an anti-acne gel and had antibacterial activity. In formula I with a concentration of 1% the inhibition zone formed was 36.33 mm, in formula II with a concentration of 3% the inhibition zone formed was 38.79 mm and in formula III with a concentration of 5% the inhibition zone formed was 34.27 mm. So which has optimal antibacterial activity against Propionibacterium acnes is formula II with a concentration of 3% and an area of inhibition zone of 38.79 mm.

Keywords: Acne; *Antibacterial; Propionibacterium acnes;* Red algae *(Eucheuma cottonii)*

Introduction

Skin health is important to everyone these days, and one of the skin health issues that affects appearance is acne. Acne is a chronic inflammation caused by infection of the sebaceous glands, increased sebum secretion, keratinization, inflammation, and Propionibacterium acnes in the hair follicles (Aqsha et al., 2016). Acne can affect psychologically and leave temporary reddish spots and cause scars on the skin, so medical treatment of acne such as topical therapy and systemic treatment, and non-medical therapy such as lifestyle must be carried out in a balanced way to reduce and avoid the severity of acne (Afriyanti, 2015).

Many causes of acne can occur, such as genetic, endocrine, psychological, seasonal, stress, food, sebaceous gland activity, cosmetics, and other chemicals, as well as bacterial infections. Bacteria that can cause acne include *Staphylococcus aureus, Staphylococcus epidermidis,* and *Propionibacterium acnes*. These bacteria are responsible for the formation of pus and the development of various forms of acne vulgaris (acne) (Zahrah et al., 2019).

Phytochemical tests on medicinal plants have a very important role. In general, this test is used to determine the content contained in plants, where this content itself is a compound content that is not needed or needed for the normal function of the plant, but can play a very active role in preventing disease because it has a very good effect on human health (Fadillah et al., 2020).

How to Cite:
Awaluddin, N., Thayeb, A. M. D. R., Utari, A. U., Awaluddin, A., & Caronge, N. P. (2023). Formulation and Activity Test of Red Algae Extract Gel (Eucheuma cottonii) Against Propionibacterium acnes Bacteria. *Jurnal Penelitian Pendidikan IPA*, *9*(11), 10356–10363. https://doi.org/10.29303/jppipa.v9i11.5513

Secondary metabolites are not only found in plants whose habitat grows on land but also in plants that live in the sea, such as red algae (*Eucheuma cottonii*), including plants in the phylum Rhodophyta. As the name suggests, the main characteristic of red algae is its reddish color. The red color is caused by very large amounts of the pigment phycoentrin which is also used for photosynthesis. Ordinary people know this plant better than seaweed. There are many types of seaweed, when compared between green and brown seaweed, red seaweed contains more metabolite compounds, both primary and secondary (Amaranggana et al., 2017).

Red algae have long been used by humans for food, animal feed, fertilizer, and medicines such as relieving fever, gallstones, and kidney and stomach diseases. As a secondary metabolite, it has shown interesting biological activities such as antiviral, antifungal, anti-inflammatory, and antimicrobial activities. The use of antibiotics can inhibit bacteria. Thus, the discovery and development of antibacterial research have become an important issue (Wahyuni, 2016).

Red algae contain flavonoids where the flavonoids are phenolic compounds. Phenol is an alcohol that is acidic and is also commonly referred to as carbolic acid. Phenol has the potential to denature proteins so that cell membranes can be damaged. The acidic atmosphere caused by the presence of phenol can influence the growth of bacteria (Dwyana et al., 2012).

The research related to this title aims to determine the possibility of making red algae extract in the form of a physically stable gel preparation and to find out whether the red algae gel preparation can inhibit the growth of Propionibacterium acnes. Red algae According to research conducted by Sareong (2016), red algae at concentrations of 0.1%, 0.25%, 0.5%, 1%, and 1.5% was concluded to have biological antibacterial activity against Staphylococcus aureus and Salmonella typhi. So we want to continue this research by increasing the concentrations of 1%, 3%, and 5% produced in the gel formulation.

Method

This research is an experimental laboratory research by formulating red algae gel preparations and testing antibacterial activity against *Propionibacterium acnes* which causes acne.

Tools and Materials

The tools used include an autoclave (GEA), desiccator, incubator (I8-One), laminar airflow (Mon Mouth), oven (Yenaco), and viscometer (NDJ-8S). The materials used include distilled water, aluminum foil, *Propionibacterium acnes* bacteria, carbopol, 96% ethanol red algae extract, glycerin, parchment paper, filter paper, physiological solution (NaCl 0.9%), MHA media (Muller Hinton Agar), triethyleneolamine (TEA).

Work Procedures

1) Sampling

The sample that will be used in this research is red algae obtained at the BBPAP (Brackish Water Fisheries Cultivation Center) Takalar office.

2) Simplicia Processing

Simplicia processing begins with preparing the raw materials, where the raw materials used are 30 kg of red algae. After wet sorting is carried out to separate the raw materials from foreign objects that can affect the quality of the simplicia. After the wet sorting is complete, washing is carried out to remove the impurities contained in the two simplicia. Washing is carried out under running water using PDAM water to avoid microorganism contamination of the raw material. After that, drying is carried out to remove water content and make the raw material more durable. After that, it is sorted dry to clean impurities in the form of foreign objects contained in the simplicia. Then chop or change the sample size to small pieces using scissors.

3) Extraction of red algae

Extraction is carried out by maceration. Take 500 g of red algae powder, put it in a glass jar, then add 1.5 L of 96% ethanol solvent until the simplicia powder is completely submerged and then close tightly. Store in a place protected from direct sunlight for 3 x 24 hours, stirring occasionally. After 3 days, the mixture of simplicity and ethanol was filtered with filter paper to obtain a liquid extract. The precipitate was macerated again for 3 days with 1.5 L of 96% ethanol. Filter again after 3 days to get a liquid extract. The two liquid extracts were concentrated using a rotary evaporator at 40°C to produce a thick extract (Numberi, 2020).

4) Alcohol-free test

The alcohol-free test is carried out by adding 2 drops of concentrated H_2SO_4 and sulfuric acid to the extract and then heating it. The extract will be said to be alcohol-free if it no longer smells of the ester smell typical of ethanol (Kurniawati, E, 2015).

5) Making red algae gel formulations

Prepare the tools and materials that will be used. The ingredients to be used are weighted according to the existing formula. 100 ml of water is heated at a temperature of 70℃, after which the carbopol is developed so that a gel mass can be formed. Mix TEA and glycerin into the previous mixture and stir until

homogeneous. Next, add enough distilled water to 100 ml and stiruntil homogeneous, add red algae extract and stir again until homogeneous.

Table 1. Red Algae Gel Formulation

		Concentrasion (%b/v)			
Material name	Unility	F0	F1	F2	F3
Red algae extract	active ingredients	-	1	3	5
Carbopol	Gelling agent	0.5	0.5	0.5	0.5
Trietilenolamin	Penstabil	0.5	0.5	0.5	0.5
Gliserin	Preservative and humectant	10	10	10	10
Aquadest ad	Solvent	100	100	100	100

Information: Formula 0= Negative control gel without red algae extract; Formula 1= Red algae extract 1%; Formula 2= Red algae extract 3%; Formula 3= Red algae extract 5%.

6) Evaluate the gel preparation

a. Organoleptic test

This test is carried out visually through shapes, colors, and formations that provide an overview. It is a transparent-colored gel with a semi-solid consistency (Rahmatullah et al., 2020).

b. Homogeneity test

The homogeneity test will be carried out by spreading the gel sample on a sheet of glass or other transparent material, but the mixture must spread evenly and without large particles (Rahmatullah et al., 2020).

c. PH Test

To do this, the pH value is measured with a pH meter and the numbers printed on the device are written down. The ideal pH for skin is 4.5-6.5 (Rahmatullah et al., 2020)

d. Viscosity test

Viscosity measurements were made using a Brookfield viscometer with spindle no.4. A preparation or test sample is prepared, then the spindle is dipped into the sample and a viscosity test is carried out at a speed of 60 rpm. The viscosity of gel-like preparations is 500-10,000 mpas/cps (Rahmatullah et al., 2020).

e. Spreadability test

0.5 g gel was placed on the slide, then another slide was placed on top and left for 1 min. The diameter of the gel dispersion was calculated. A spread of 5-7 cm means a semi-solid consistency which is very pleasant to use (Rahmatullah et al., 2020).

7) Cycling test

The gel preparation is subjected to a cycling test so that the stability evaluation takes place quickly. The cycling test is carried out in 6 cycles. Every 1 cycle is carried out by storing the gel preparation at a cold temperature, namely around 4°C, for 12 hours, then removing it and then storing it at a temperature of around 40°C. After the cycling test was carried out, it was compared with the previous gel preparation (Pratasik et al., 2019).

8) Test antibacterial activity

a. Sterilization of tools

The equipment needed is washed first, then the jars are wrapped in paper and then sterilized in the oven for 2 hours at 170°C.

b. Orientation of red algae extract

The concentration of red algae extract is determined by conducting orientation. Extract orientation starts by using the lowest concentration, namely 1% (1 gram), 3% (3 grams) and 5% (5 grams).

c. Rejuvenation of Propionibacterium acnes bacteria

One cycle was taken from the isolation of Propionibacterium acnes bacteria which was cultured, then inoculated in MHA slanted medium and incubated for 1×24 hours (Wijayati et al., 2014).

d. Preparation of Propionibacterium acnes bacterial suspension

Put 3 ml of physiological solution (NaCl 0.9%) into a test tube, then take one cycle of the rejuvenation of Propionibacterium acnes bacteria until the solution becomes cloudy (Siahaan et al., 2013).

e. Testing the inhibitory power of red algae extract gel preparations

A total of 10 mL of MHA medium was poured into a sterile petri dish. Previously, iron tools had been placed to form the wells. Leave it for a few minutes until it solidifies. Then pour in another 5 mL of MHA medium which has been mixed with one dose of the Propionibacterium acnes bacterial suspension and let it sit again until it solidifies. Next, take a tool and insert a gel sample with a concentration of 1%, 3%, 5% which will be tested in the wells that have been formed. After that, it was incubated for 1×24 hours, after which the diameter of the growth barrier area (clear zone) around the well was measured with a caliper (Indarto et al., 2019).

9) Data Analysis

Data collection carried out in this research was carried out by looking at the results of research on the formulation and activity test of red algae extract anti-acne gel (*Eucheuma cottonii*) against Propionibacterium acnes bacteria which were presented in tabular form using the paired t-test method and the ANOVA method.

Result and Discussion

The results of the evaluation of the anti-acne gel preparation with red algae extract showed the following results:

The % yield results obtained were based on research, which was obtained at the initial stage by weighing 500 grams of red algae powder which had been dried and chopped into small pieces, then a maceration process was carried out for 3×24 hours with 3,000 mL of 96% ethanol while stirring and filtering. The filtrate is added with 96% ethanol and macerated again. From the maceration process, 51.3 grams of thick extract was obtained, so that a soaking percentage of 10.26% could be obtained.

In the evaluation of preparations, there are several tests, the first is the organoleptic test. The results obtained based on research are as follows:

Table 2. Organoleptic Test

Formula	Form		Color		Form	
	Before cycling test	After cycling test	Before cycling Test	After cycling test	Before cycling Test	After cycling test
K+	Gel	Gel	White	White	Thypical	Thypical
F0	Gel	Gel	Clear	Clear	Thypical	Thypical
F1	Gel	Gel	Green	Green	Thypical	Thypical
F2	Gel	Gel	Dark green	Dark green	Thypical	Thypical
F3	Gel	Gel	Dark green	Dark green	Thypical	Thypical

Information: K+ =Positive control 2.5% Benzolac gel; F0 = Negative control gel formula without extract; F1 = Gel formula with extracts 1%; F2 = Gel formula with extracts 3%; F3 = Gel formula with extracts 5%.

The first test carried out is an organoleptic test which includes shape, color, and odor. The results of observations before and after the Cycling test process carried out by the organoleptic test of the red algae extract anti-acne gel preparation showed the results as in Table 2. After the Cycling test was carried out, the results showed that there was no change in the shape, color, and odor of the five preparations. From these results, it can be concluded that the preparation remains stable before and after the Cycling test. The preparation is declared stable if there is no significant difference in the results of the parameters observed before and after the cycling test (Sayuti, 2015).

The second is the Homogeneity Test. The results obtained based on research are as follows:

Table 3. Observation Results of the Homogeneity Test of the Anti-acne Gel Preparation

Formula	Homogeneity	
	Before Cycling test	After Cycling test
K+	Homogeneous	Homogeneous
F0	Homogeneous	Homogeneous
F1	Homogeneous	Homogeneous
F2	Homogeneous	Homogeneous
F3	Homogeneous	Homogeneous

Information: K+ = Positive control 2.5% benzolac gel; F0 = Positive control 2.5% benzolac gel; F1= Gel formula with 1% extract; F2 = Gel formula with 3% extract; F3 = Gel formula with 5% extract.

Next, a homogeneity test was carried out. In the homogeneity test, the preparation is smeared on one glass after which it is pressed using another glass and it is seen whether the preparation is perfectly homogeneous which can be indicated by the absence of visible grains. Based on Table 3. On the results of observations of the gel preparation homogeneity test, it was found that each preparation was homogeneous, because there were no grains visible on the glass either before the Cycling test was carried out or after the Cycling test was carried out (Rahmatullah et al., 2020).

The third is the Spreadability Test. The results obtained based on research are as follows:

Table 4. Observation Results of the Spreadability Test of Anti-acne Gel Preparations

Formula	Spread Power (Cm)		Requerement	Significant
	Before cycling test	After cycling test		
K+	6	6.2		P > 0.05
F0	5.5	5.3		P > 0.05
F1	6.5	6.0	5-7 cm	P > 0.05
F2	5.5	5.5		P > 0.05
F3	5.5	5.2		P > 0.05

Information: K+ = Positive control 2.5% benzolac gel; F0= Negative control gel formula without extract, F1= Gel formula with 1% extract; F2= Gel formula with 3% extract; F3= Gel formula with 5% extract; p > 0.05= There is no significant difference (Stable).

After that, the test continued with the spreading power test. In the spreadability test, the preparation is smeared on one glass, then pressed against another glass, and given a load weighing 150 grams. After that, wait at least one minute and then measure the spreadability of the gel using a ruler.

Based on table 4 observation results of the spreadability test of gel preparations, it is found that in K+ before the Cycling test, the spreadability was 6 cm and after the Cycling test the spreadability was 6.2 cm. At K- before the cycling test was carried out the spread power was 5.5 cm and after the cycling test was carried out the spread power was 5.3 cm. In Formula 1, before the cycling test is carried out, the spread power is 6.5 cm

and after the cycling test is carried out the spread power is 6.0 cm. In Formula 2 before the Cycling test the spread power is 5.5 cm and after the Cycling test, the spread power remains 5.5 cm. Meanwhile, in formula 3, before the cycling test was carried out, the spread power was 5.5 cm and after the cycling test was carried out the spread power was 5.2 cm. The differences in the spreadability test are influenced by temperature changes that occur, where changes occur in the gel polymer. If a gel is stored at a high temperature, the ball-shaped coils will unwind in the polymer chains, causing the spreadability to increase, whereas if a gel is stored at a low temperature, the polymer chains will join together and shorten, which over time will cause a change in the spreadability.

For the Paired sample t-test, the dispersion power has a p-value> 0.05, which means it is stable or there is no significant difference in the data for each formula before and after the Cycling test is carried out. If we look at the requirements for good spreadability parameters for gel preparations which are in the range of 5-7 cm, it can be concluded that all red algae gel preparation formulas both before the Cycling test is carried out and after they have met the requirements for a good spreadability range (Fujiastuti et al., 2015; Rahmatullah et al., 2020).

The fifth test is the pH test. The results obtained based on research are as follows:

Table 5. Observation Results of the pH Test of the Anti-acne Gel Preparation

Formula	pH				Syarat	Significant
	Before cycling test	Standard Deviation	After cycling test	Standard Deviation		
K+	5.4		5.2			P > 0.05
F0	5.4		5.5			P > 0.05
F1	5.5	0.222711	5.7	0.293939	4.5-6.5	P > 0.05
F2	5.6		5.7			P > 0.05
F3	6.0		6.1			P > 0.05

Information: K+= Positive control 2.5% benzolac gel; F0: Negative control gel formula without extract; F1: Gel formula with 1% extract; F2= Gel formula with 3% extract; F3= Gel formula with 5% extract; p > 0.05= There is no significant difference (Stable).

Next is the pH test which is carried out using a pH meter which is inserted into the preparation that has previously been diluted with 20 ml of distilled water, then left to stand until stable and the pH displayed on the pH meter is recorded. Based on Table 5, the results of observations of the pH test of the gel preparation were obtained at K+ before the cycling test was carried out, the pH was 5.2 and after the cycling test was carried out the pH increased to 5.4. In K- before the cycling test was carried out the pH was 5.4 and after the cycling test was carried out the pH rose to 5.5. In Formula 1, before the Cycling test was carried out, the pH was found to be 5.5 and after the Cycling test was carried out the pH increased to 5.7. In formula 2 before the cycling test was carried out the pH was 5.6 and after the cycling test was carried out the pH rose to 5.7. Meanwhile, in formula 3, before the cycling test was carried out, the pH was 6 and after the cycling test was carried out, the pH rose to 6.1.

The pH test after the Cycling test experienced an increase in the pH amount, this was due to the influence of temperature during storage where the gel preparation was penetrated by acidic gases. Based on the Paired Sample t-test, the pH has a p-value <0.05, which means it is unstable or there is a significant difference in the data for each formula before and after the Cycling test. This is possibly caused by human error where the researcher when diluting the gel preparation was not homogeneous or evenly mixed. However, based on these measurement results, all red algae gel preparation formulas have met the pH requirements for gel preparations, namely according to the skin pH which is in the range of 4.5-6.5 (Ardiati, 2018; Rahmatullah et al., 2020).

In the sixth test, there is a Viscosity Test. The results obtained based on the research are shown in Figure 6. The final test in evaluating this gel preparation is the viscosity test which is carried out by measuring using a Brookfield Viscometer. The gel preparation is poured into the cup and then the viscometer is fitted with spindle no. 4 and set the speed at 60 rpm. The viscosity results are recorded after the numbers stabilize. Based on Table 4.6, the results of observations of the gel preparation viscosity test, it was found that in K+ before the cycling test was carried out the viscosity was 1,130 mpas and after the cycling test was carried out it increased to 2,340 mpas. In K- before the Cycling test was carried out the viscosity was 4,190 mpas and after the Cycling test was carried out it fell to 2,560 mpas. In Formula 1 before the cycling test was carried out the viscosity was 2,590 mpas and after the cycling test was carried out it fell to 2,180 mpas. In Formula 2 before the Cycling test was carried out the viscosity was 2,500 mpas and after the Cycling test was carried out it decreased to 2,460 mpas. Meanwhile, in formula 3, before the Cycling test was carried out, the viscosity was 2,960 mpas and after the Cycling test was carried out it fell to 2,030 mpas.

Table 6. Observation Results of the Viscosity Test of Anti-acne Gel Preparations

Formula	Viscosity (mpas)		Requerement	Significant
	Before cycling test	After cycling test		
K+	1.130	2.340		P > 0.05
F0	4.190	2.560		P > 0.05
F1	2.590	2.180	500-10.000 mpas	P > 0.05
F2	2.500	2.460		P > 0.05
F3	2.960	2.030		P > 0.05

Information: K+= Positive control 2.5% benzolac gel; F0= Negative control gel formula without extract; F1= Gel formula with 1% extract; F2= Gel formula with 3% extract; F3= Gel formula with 5% extract; p > 0.05= There is no significant difference (Stable).

After the Cycling test was carried out, the viscosity of the gel preparation decreased because the liquid in the gel preparation came out or experienced syneresis and was influenced by the temperature during storage. Viscosity will decrease if the temperature is increased. This is because the distance between the atoms will be enlarged due to the heat obtained, resulting in a reduction in the force between the atoms, the distance becomes wider so that the viscosity decreases. Based on the Paired Sample t-test, the viscosity has a p-value> 0.05, which means it is stable or there is no significant difference in the data for each formula before and after the Cycling test. Based on these results, all red algae gel preparations have met the viscosity requirements, namely 500-10,000 mpas (Ardiati, 2018; Haryati et al., 2017; Rahmatullah et al., 2020).

In the Propionibacterium acnes Bacterial Activity Test. The results obtained based on research are as follows:

Table 7. Observation Results of Propionibacterium Acnes Bacterial Activity Tests

Formula	Average diameter (mm)	Category (Haryati et al, 2017)		Significant
		Disk Method	Same age method	
K+	16.42	Strong	Strong	
F0	0	Nothing	Nothing	
F1	36.33	Very strong	Very strong	P< 0.05
F2	38.79	Very strong	Very strong	
F3	34.27	Very strong	Very strong	

Figure 8. Inhibitory Power of Red Algae Extract

Concentration	Mean Zone of Inhibition ± Standard Deviation of P. acne
K+	16.42 ± 1.112145
F0	0±0
F1	36.333333 ± 0.75361
F2	38.79±1.129956
F3	34.26667±1.234919

Information: K+ =Positive control 2.5% benzolac gel; F0= Negative control gel formula without extract; F1 = Gel formula with 1% extract; F2 = Gel formula with 3% extract; F3 = Gel formula with 5% extract; Diameter ≤ 5 mm= Weak category; Diameter 5-10 mm = Medium category; Diameter 10-20 mm= Strong category; Diameter ≥ 20 mm= Very strong category; p < 0.05= There is a significant difference (affects inhibition)

This research was carried out using the agar (disk) diffusion method using the Wells method to measure the diameter of the inhibitory power of red algae (*Euchema cotoni*) extract on the growth of Propionibacterium acnes, one of the bacteria that causes acne.

Next, an antibacterial activity test was carried out by determining the concentration of red algae (Eucheumacottonii) extract in inhibiting the growth of Propionibacterium acnes bacteria. This testing process uses the pitting method, this is due to the method of drilling the inhibition zone formed by isolate activity, which can be seen from bottom to top on the surface of the media, so that measurements of the inhibition zone for bacterial growth can be carried out easily (Haryati et al., 2017).

The results of the Propionibacterium acnes growth activity test in the resulting inhibition zone showed that the best composition for testing the antibacterial activity of red algae (Eucheuma cottonii) extract was Formula 2 (3% concentration) with a diameter of 38.79 mm. This shows that the formula has very strong antibacterial potential. Followed by formula 1 (1% concentration), with a diameter of 36.33 mm which is also included in the very strong category. Likewise, Formula 3 (5% concentration) has an inhibition zone of 34.27 with very strong degrees. The negative control (K-) does not have an inhibition zone. Meanwhile, the positive control is the 16.42mm blind spot which is in the strong category. When the three formulations 1%, 3%, and 5% were compared with the positive control 2.5% benzene, the resulting inhibitory area was larger. This may be because the combination of red algae and glycerin has a synergistic effect in inhibiting acne growth, whereas benzolac 2.5% was used as a positive control, which is usually indicated for less severe forms of acne.

Anti-inflammatory gel made from red algae (Eucheuma cottonii) extract has antibacterial properties, namely red algae (Eucheuma cottonii) extract which can inhibit the growth of Propionibacterium acnes bacteria. Antimicrobials are classified as bacteriostatic because these compounds can only inhibit bacterial growth if the

compound is given continuously, while they are bactericidal if the zone of inhibition is enlarged without the addition of compounds because these compounds can kill from physiological activity. bacteria are stopped. This is based on research from Mycek (2001) (Pringgenies et al., 2020).

From the bacterial activity evaluation data, then analyzed using one-way ANOVA by checking the normality of the gel's drug inhibition power, it can be concluded that the abnormal drug inhibition was caused by a value <0.05 - 0.03, so this was continued by running a non-parametric statistical test with Mann-Whitney u to determine the differences between the five test groups. The table shows that (K+) compared to (K-), p-value < 0.05, which means there is a significant difference with the formula. Likewise, if (K+) is compared with F1, F2, and F3, the p-value = 0.05 means that the formula has inhibitory power, or it can be said that the activity is almost the same. An inhibition zone ≤5 mm is categorized as weak, 5-10 mm is categorized as moderate and 10-20 mm is categorized as strong, and ≥ 20 is categorized as very strong (Lingga et al., 2016; Sibero et al., 2019; Winastri et al., 2020).

Conclusion

Based on the results of this research, it can be said that red algae (*Eucheuma cottonii*) extract can be produced and is stable as an anti-acne formulation. Red algae extract (*Eucheuma cottonii*) has antibacterial properties which are very effective in preventing the growth of Propionibacterium acnes bacteria.

Author Contributions
Data analysis: N.A; conceptualization: A.M.D.T; methodology: A.U.U; visualization: A.A; editing: N.P.C.

Funding
No external funding.

Conflicts of Interest
No conflict interest.

References

Afriyanti, R. N. (2015). Akne Vulgaris Pada Remaja. *Medical Faculty of Lampung University*, *4*(6), 102–109. Retrieved from https://juke.kedokteran.unila.ac.id/index.php/majority/article/view/616

Amaranggana, L., & Wathoni, N. (2017). Manfaat Alga Merah (Rhodophyta) Sebagai Sumber Obat dari Bahan Alam. *Farmasetika.Com (Online)*, *2*(1), 16. https://doi.org/10.24198/farmasetika.v2i1.13203

Aqsha, A. C., N. R., S., Dea A., P., Nadya, A., Stefany V., A., Ikhfan T., J., Siti Halima, H., Novi Ayu, A. S., S., A., C., D. G., & Rif'atul I., E. (2016). Profil Pemilihan Dan Penggunaan Produk Antijerawat Yang Tepat Pada Mahasiswa. *Jurnal Farmasi Komunitas*, *3*(1), 18–22. Retrieved from https://journal.unair.ac.id/download-fullpapers-jfk1dbe4e3b7a2full.pdf

Ardiati, K. N. (2018). *Formulasi Sediaan Gel Ekstrak Daun Lidah Mertua (Sansivieria trifasciata) Dengan Gelling Sgent Karbopol - 934 Dan Uji Aktivitas Antibakteri Secara In Vitro Terhadap Staphylococcus epidermidis*. Universitas Muhammadiyah Surakarta.

Dwyana, Z., & Johannes, E. (2012). Uji Efektivitas Ekstrak Alga Merah Euchema cottonii sebagai Antibakteri terhadap Bakteri Patogen. *Jurnal Ilmu Kefarmasian*, *7*(1), 1–7. Retrieved from https://core.ac.uk/reader/25489644

Fadillah, N., Pebrianti, N., & Mukkun. (2020). *Skrining Fitokimia*. Makassar: Universitas Mega Rezky.

Fujiastuti, T., & Sugihartini, N. (2015). Sifat Fisik dan Daya Iritasi Gel Ekstrak Etanol Herba Pegagan (Centella asiatica L. Urban) Dengan Variasi Jenis Gelling Agent. *Pharmacy*, *12*(01), 87–90. Retrieved from https://jurnalnasional.ump.ac.id/index.php/PHARMACY/article/view/810

Haryati, S. D., Darmawati, S., & Wilson, W. (2017). Perbandingan Efek Ekstrak Buah Alpukat (Persea americana Mill) terhadap Pertumbuhan Bakteri Pseudomonas aeruginosa dengan Metode Disk dan Sumuran. *Prosiding Seminar Nasional Publikasi Hasil-Hasil Penelitian Dan Pengabdian Masyarakat "Implementasi Penelitian Dan Pengabdian Masyarakat Untuk Peningkatan Kekayaan Intelektual,"* 348–352. Retrieved from https://jurnal.unimus.ac.id/index.php/psn12012010/article/view/2886

Indarto, I., Narulita, W., Anggoro, B. S., & Novitasari, A. (2019). Aktivitas Antibakteri Ekstrak Daun Binahong Terhadap Propionibacterium Acnes. *Biosfer: Jurnal Tadris Biologi*, *10*(1), 67–78. https://doi.org/10.24042/biosfer.v10i1.4102

Lingga, A. R., Pato, U., & Rossi, E. (2016). Uji Antibakteri Ekstrak Batang Kecombrang (Nicolaia speciosa Horan) terhadap Staphylococcus aureus dan Escherichia coli. *JOM Faperta*, *2*(2), 1–15. Retrieved from https://www.neliti.com/publications/186658/uji-antibakteri-ekstrak-batang-kecombrang-nicolaia-speciosa-horan-terhadap-staph

Numberi, A. M. (2020). Uji Stabilitas Fisik Sediaan Masker Gel dari Ekstrak Alga Merah (Poryphyra sp). *Majalah Farmasetika*, *5*(1), 1–17. https://doi.org/10.24198/mfarmasetika.v5i1.2406

6
Pratasik, M. C. M., Yamlean, P. V. Y., & Wiyono, W. I. (2019). Formulasi dan Uji Stabilitas Fisik Sediaan Krim Ekstrak Etanol Daun Sesewanua (Clerodendron squamatum Vahl.). *Pharmacon*, *8*(2), 261. https://doi.org/10.35799/pha.8.2019.29289

Pringgenies, D., Setyati, W. A., Wibowo, D. S., & Djunaedi, A. (2020). Aktivitas Antibakteri Ekstrak Jeruju Acanthus ilicifolius terhadap Bakteri Multi Drug Resistant. *Jurnal Kelautan Tropis*, *23*(2), 145–156. https://doi.org/10.14710/jkt.v23i2.5398

Rahmatullah, S., Agustin, W., & Kurnia, N. (2020). Formulasi Dan Evaluasi Sediaan Gel Hand Sanitizer Sebagai Antiseptik Tangan Dengan Variasi Basis Karbopol 940 Dan Tea Chmk Pharmaceutical Scientific Journal. *Chmk Pharmaceutical Scientific Journal*, *3*(September 2020), 189–194. Retrieved from https://cyber-chmk.net/ojs/index.php/farmasi/article/download/847/300

Sayuti, N. A. (2015). Formulasi dan Uji Stabilitas Fisik Sediaan Gel Ekstrak Daun Ketepeng Cina (Cassia alata L.). *Jurnal Kefarmasian Indonesia*, *5*(2). https://doi.org/10.22435/jki.v5i2.4401.74-82

Siahaan, S. P. L., Isnindar, & Rialita, A. (2013). Uji Aktivitas Antibakteri Infusa Biji Buah Langsat (Lansium Domesticum Cor.) terhadap Salmonella Typhi. *Jurnal Mahasiswa PSPD FK Universitas Tanjungpura*, *1*(1). Retrieved from https://jurnal.untan.ac.id/index.php/jfk/article/viewFile/6340/6517

Sibero, H. T., Wayan, I., Putra, A., & Anggraini, D. I. (2019). Tatalaksana Terkini Acne Vulgaris. *JK Unila*, *3*(2), 313. Retrieved from http://repository.lppm.unila.ac.id/43373/

Wahyuni, S. (2016). Uji Aktivitas Antibakteri Alga Merah Eucheuma spinosum Asal Perairan Galesong Kabupaten Takalar Terhadap Bakteri Salmonella thypi dan Bacillus subtilis I. *Nature Methods*, *7*(6), 2016. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26849997%0Ahttp://doi.wiley.com/10.1111/jne.12374

Wijayati, N., Astutiningsih, C., Mulyati, S., & Artikel, I. (2014). Transformasi α-Pinena dengan Bakteri Pseudomonas aeruginosa ATCC 25923. *Biosaintifika: Journal of Biology & Biology Education*, *6*(1), 24–28. https://doi.org/10.15294/biosaintifika.v6i1.2931

Winastri, N. L. A. P., Muliasari, H., & Hidayati, E. (2020). Aktivitas Antibakteri Air Perasan Dan Rebusan Daun Calincing (Oxalis corniculata L.) TERHADAP Streptococcus mutans. *Berita Biologi*, *19*(2). https://doi.org/10.14203/beritabiologi.v19i2.378

6
Zahrah, H., Mustika, A., & Debora, K. (2019). Aktivitas Antibakteri dan Perubahan Morfologi dari Propionibacterium Acnes Setelah Pemberian Ekstrak Curcuma Xanthorrhiza. *Jurnal Biosains Pascasarjana*, *20*(3), 160. https://doi.org/10.20473/jbp.v20i3.2018.160-169