**Anti-Acne Facial Wash Formulation From Red Betel Leaf Extract (Piper crocatum Ruiz & Pav)**

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**ARTICLE HISTORY**

 Received: Revised: Accepted:

**Abstract**

*Acne can occur because of dust, sweat and dirt that sticks to the skin and then will cause fat deposits called blackheads, which accompanied by bacterial infection will cause inflammation. Therefore, skin hygiene must be maintained, one of which is by utilizing natural ingredients that have antibacterial activity. Red betel leaves (Piper crocatum Ruiz & Pav) is known to have antibacterial activity. The purpose of this study was to make a facial wash formulation from red betel leaf extract which has antibacterial activity against Propionibacterium acnes.* *Red betel leaves were extracted by maceration method. Antibacterial test was carried out on Propionibacterium acnes using the well diffusion method. The combination of red betel leaves extract was made in 3 concentrations, namely 10%, 15%, and 20%. The results showed that facial wash with a concentration of 10% extract had an inhibition zone of 29 mm, 15% of extract had inhibition zone of 32.6 mm, and 20% of extract had inhibition zone of 35.3 mm. The three formulations had optimum antibacterial activity which were included as strong category >21-30 mm. Evaluation of preparations that have complied with the requirements of SNI-19-4380-1996, including pH, viscosity, specific gravity and foam height. Thus the results concluded that the facial wash formulation was stable, safe and effective.*

***Key words*:** *Antibacterial, Facial Wash, Propionibacterium**acnes, Red Betel*

**Introduction**

People in Indonesia from the past until now still use plants as a treatment because it is seen as more secure, and the side effects are much smaller. One of the plants that has the ability to ensure skin health is red betel leaf. Red Betel Leaf (Piper crocatum Ruiz & Pav) has antibacterial activity because a number of compounds work by changing the characteristics of bacterial cell proteins. As a result, the permeability of the bacterial cell wall increases which leads to the lysis of the bacteria. Red Betel leaf extract contains chemical compounds such as alkaloids, flavonoids, tannins, and essential oils that have potential as antibacterials.1 These compounds can overcome skin problems that are experienced by many people, namely acne.

Acne can be caused by the formation of excess sebum that is deposited in the follicles, so that the skin pores are clogged with fat deposits. Dust, sweat and dirt eventually make the fat deposits turn black, otherwise known as blackheads. Blackheads with bacterial infection create inflammation, namely acne.2 Propionibacterium acnes is the main organism in the process of inflammatory lesions in acne, where its growth increases due to increased sebum production. This bacteria must be inhibited to reduce inflammation.3 By cleaning the facial skin to avoid impurities, sweat, and bacteria using facial wash.

Facial wash or liquid facial soap is a mild facial cleanser, and functions to maintain skin hygiene. According to SNI 16-4380-1996 concerning facial skin cleansers, a good facial liquid soap must meet the requirements for safe use. Namely having a good appearance, pH between 4.5-7.8, specific gravity between 0.925-1.05 and viscosity between 3,000-50,000 cps. Liquid soap is more widely used by the public because of its more effective and practical use. And many formulations have been made as ordinary soaps and soaps that have antibacterial activity.

As in Agusta W.R.'s research, an antibacterial liquid soap preparation was made, and it was found that Red Betel leaf extract was able to inhibit the growth of Staphylococcus aureus bacteria.4 In Umami Zaitul's research, a liquid soap preparation was made as an antiseptic and it was found that red betel leaf extract had inhibition against Staphylococcus aureus.5

In research conducted by Desmanova, et al., solid soap preparations were made and the results showed that the content of triterpenoid compounds, flavonoids and tannins showed activity as antibacterials that were able to fight several gram-positive and negative bacteria.1 Also in the research of Syafriana, et al., showed the results of ethanol extract of Red Betel leaves having antibacterial activity on Propionibacterium acnes which was shown through the formation of diameter inhibition (DDH) at concentrations of 10%, 15%, 20%, and 25%. And the results of the minimum inhibitory concentration (KHM) test were shown at a concentration of 10%.6

Based on the above research, Red Betel leaf extract has antibacterial activity and can inhibit bacterial growth. Therefore, this study aims to make a new formulation of Red Betel leaf extract as a liquid facial soap that has antibacterial activity against Propionibacterium acnes.

The results of this study are expected to be useful for researchers and the community. And can add insight and knowledge about the utilization of plants as well as add to the science in the field of cosmetics and pharmacy about the use of natural ingredients as antiacne.

**Tools, Materials and Research Methods**

**Tools**

The equipment used in this study were universal pH, vernier, spatel, glass funnel, ose wire, test tube (Pyrex), measuring cup (Pyrex), stirring rod, dropper pipette, Erlenmeyer (Pyrex), analytical balance (Kern®analytical balance), petri dish, incubator (Memmert®), electric stove (Maspion), filter paper, vaporizer cup, viscometer (Brookfield), furnace (Ceramic Fiber Muffle Furnace®), mortar and pestle, autoclave (Allamerican), rotary evaporator (IKA®RV 10 basic), glass jar (Pyrex), water bath (Memmert®), tweezers, micropipette (Microlit), stirrer (Dragon Lab).

**Materials**

The materials in this study are Red Betel leaves. Aquadest (Daya Chemical), 96% technical ethanol (Daya Chemical), 70% technical ethanol (Daya Chemical), mueller hinton agar (Nitra Kimia), 0.9% physiological NaCl (Daya Chemical), dimethyl sulfoxide (Daya Chemical), olive oil (CV. Medan Kimia), potassium hydroxide 25% (Daya Chemical), sodium carboxyl methyl celulose (Daya Chemical), sodium lauryl sulfate (CV. Medan Kimia), butyl hydroxy anisole (PT. DPH), stearic acid (PT. DPH), citric acid (PT. DPH).

**Test Bacteria**

The test bacteria used were Propionibacterium acnes bacteria obtained from the Parasitology Laboratory of the Faculty of Medicine, University of Indonesia.

**Manufacture of Facial Wash**

**Table 1.** Red Betel Leaf Extract Facial Wash Formula

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Bahan | Basis | F1 (%) | F2 (%) |  F3 (%) |
| Red betel leaf extract | 0 | 10 | 15 | 20 |
| Olive oil | 15  | 15  | 15  | 15  |
| KOH | 8  | 8  | 8  | 8  |
| Na-CMC | 0,5  | 0,5  | 0,5  | 0,5  |
| SLS | 0,5  | 0,5  | 0,5  | 0,5  |
| Stearic acid | 0,25  | 0,25  | 0,25  | 0,25  |
| BHA | 0,5  | 0,5  | 0,5  | 0,5  |
| Aquadest | ad 100 mL | ad 100 mL | ad 100 mL | ad 100 mL |

Making liquid facial soap begins with making soap base. All ingredients were weighed first. Olive oil is placed in a porcelain petri dish, potassium hydroxide (KOH) is added to the oil, while continuing to be heated until a soap base is formed. The soap base was added with enough distilled water, add Na-CMC which was previously developed through hot distilled water, stearic acid, SLS, and BHA alternately, by stirring until homogeneous. Next, enter the red betel leaf extract and stir until homogeneous. After homogeneous facial liquid soap added distilled water to a volume of 100 mL, and put into a container. The preparation of facial liquid soap of red betel leaf ethanol extract is matched through each concentration. Furthermore, the evaluation test of facial liquid soap of red betel leaf ethanol extract was carried out through organoleptic tests, pH, viscosity, specific gravity and foam height.14

**Evaluation of Preparations**

**Organoleptic Observation**

Organoleptic tests carried out are physical tests of liquid soap including odor, shape and color.

**pH Measurement**

The pH test is carried out using a universal pH. The pH must match the pH of the facial skin, which is 4.5-7.8 (SNI 16-4380-1996).

**Viscosity Measurement**

Measurements were made using a Brookfield Viscometer. A preparation of 100 g of liquid facial soap was put into the container then installed spindle number 3, set a rotation speed of 10 rpm, then run. Measurements were taken 3 times for each preparation. The viscosity results were recorded after the viscometer showed a stable number.

**Specific gravity weighing**

The pycnometer was cleaned with acetone, dried and weighed. Put water into the pycnometer and weighed, then weigh the pycnometer containing the soap.

**Foam Height Measurement**

Facial wash was taken as much as 1 ml, put into a test tube, then added distilled water to 10 ml, shaken by flipping the test tube, then immediately measured the height of the foam formed.

**Antibacterial Activity Testing of Red Betel Leaf Extract Facial Wash**

The method used to test antibacterial activity is the well diffusion method. A total of 200 µL of each test bacterial suspension was put into a sterile petri dish then added 20 mL of Mueller Hinton Agar (MHA) medium which was still liquid and gently homogenized. After the medium had solidified, holes were punched and the wells were aseptically removed from the petri dish, forming wells that were used in the antibacterial test. 50 µL of test sample was added to each well. Petri dishes were incubated in an incubator at 37℃ for 18-24 hours. The diameter of the inhibition formed in the form of a clear zone around the wells was measured using a caliper.

**Results and Discussion**

Preliminary tests of the activity of ethanol extract of Red Betel leaves (Piper crocatum Ruiz & Pav) against Propioinibacterium acnes bacteria with concentrations of 10%, 15%, and 20% were conducted. The results showed that the ethanol extract of Red Betel leaves had antibacterial activity with an inhibition zone diameter of 29.3 mm for 10% concentration, 33 mm for 15% concentration, and 36 mm for 20% concentration. The greater the concentration of the extract, the greater the inhibition. Furthermore, testing the minimum inhibitory concentration is taken from the results of the lowest concentration that has antibacterial activity. The results showed that at concentrations of 1% - 9% there was bacterial growth. While at a concentration of 10% there is no bacterial growth. Because the 10% extract concentration already has antibacterial activity against Propionibacterium acnes bacteria characterized by the absence of bacterial growth on the media in the cup.(6)

**Table 2**. Activity Test Results of Red Betel Leaf Extracts

|  |  |  |  |
| --- | --- | --- | --- |
| Bacteria Name |  | Concentration |  |
|  | 10% | 15% | 20% |
| Propionibacterium acnes | 29,3 mm | 33 mm | 36 mm |

Organoleptic observations were made on the physical appearance of the preparation to determine the absence of changes including color, odor, and shape. From the observations obtained, the color, odor, and shape of the F0 facial wash preparation were white, odorless, and thick, while the F10%, F15%, and F20% were dark green, smelled distinctive, and thick. So that the four formulas are stable in storage for 28 days.

**Table 3.** Organoleptic Evaluation Results

|  |  |
| --- | --- |
| Products | Odor; Shape; Color |
| F0 | F1(10%) | F2(15%) | F3(20%) |
| Day 0 | TB; K; P | BK; K; HT | BK; K; HT | BK; K; HT |
| Day 7 | TB; K; P | BK; K; HT | BK; K; HT | BK; K; HT |
| Day 14 | TB; K; P | BK; K; HT | BK; K; HT | BK; K; HT |
| Day 21 | TB; K; P | BK; K; HT | BK; K; HT | BK; K; HT |
| Day 28 | TB; K; P | BK; K; HT | BK; K; HT | BK; K; HT |

The pH test is one of the quality requirements of liquid soap. because liquid soap is in direct contact with the skin and can cause problems if the pH does not match the pH of the skin. The amount of alkali in each formula is the same, then the pH test uses a universal pH so that the pH test results in the four formulas produced have no difference and meet the requirements of a good facial liquid soap. (14)

**Table 4**. Results of pH Evaluation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Preparations |  |  | pH |  |  |
| Day 0  | Day 7  | Day 14  | Day 21  | Day 28 |
| F0 | 5,65 | 5,64 | 5,65 | 5,6 | 5,6 |
| F10% | 5,52 | 5,53 | 5,5 | 5,5 | 5,49 |
| F15% | 5,51 | 5,52 | 5,5 | 5,51 | 5,5 |
| F20% | 5,48 | 5,4 | 5,4 | 5,41 | 5,39 |

Viscosity testing was carried out to see the viscosity of soap base preparations and preparations that had been added to various concentrations of extracts during 28 days of storage, measuring viscosity using a Brookfield Viscometer spindle number 3 and a speed of 10 rpm. From the observation results for 28 days, it can be seen that the viscosity of all facial liquid soap formulas increases according to the increase in extract concentration in the formulation. The soap base has the lowest viscosity due to the absence of added extract, Formula 1 has a low viscosity with the addition of 10% extract, and formula 3 has the highest viscosity with the addition of 20% extract. However, the face liquid soap of red betel leaf ethanol extract decreased during 28 days of storage and was still within the range of SNI requirements. According to the data obtained, all formulas either with or without red betel leaf ethanol extract are in accordance with the SNI for facial soap cleansers. (17)

**Table 5.** Viscosity Evaluation Results

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Preparations |  |  | Viscosity(cps) |  |  |
|  | Day 0 | Day 7 | Day 14 | Day 21 | Day 28 |
| F0 | 3500 | 3500 | 3500 | 3500 | 3500 |
| F10% | 4000 | 4000 | 4000 | 3900 | 3900 |
| F15% | 4600 | 4600 | 4600 | 4500 | 4500 |
| F20% | 5000 | 5000 | 5000 | 4900 | 4900 |

Specific gravity testing was carried out to determine the specific gravity of liquid soap preparations and to determine the effect of the ingredients used in the fomulation on the specific gravity of the soap produced. According to SNI, the specific gravity of liquid soap is 0.925-1.05 g/mL. from the observations obtained, the specific gravity of the soap base is 1.00 g/mL, the 10% concentration formula is 1.02 g/mL, the 15% concentration formula is 1.02 g/mL, and the 20% concentration formula is 1.03 g/mL. the data is obtained from the average value results so that the 10% formula and 15% formula look like they have the same results. The greater the concentration of extract in each formula, the greater the specific gravity. (18) All concentrations have a specific gravity of liquid soap that is in accordance with the standards set by SNI.

**Table 6**. Specific gravity evaluation results

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Preparations | Day 0 | Day 7 | Day 14 | Day 21 | Day 28 |
| F0 | 1,00 g/mL | 1,00 g/mL | 1,00 g/mL | 1,00 g/mL | 1,00 g/mL |
| F10% | 1,02 g/mL | 1,02 g/mL | 1,02 g/mL | 1,02 g/mL | 1,02 g/mL |
| F15% | 1,02 g/mL | 1,02 g/mL | 1,02 g/mL | 1,02 g/mL | 1,02 g/mL |
| F20% | 1,03 g/ml | 1,03 g/mL | 1,03 g/mL | 1,03 g/mL | 1,03 g/mL |

The foam height test was conducted to see the foam power produced by the liquid soap made. From the observation, the foam height of the soap base is 3cm, 10% formula is 3cm, 15% formula is 3cm, and 20% formula is 3cm. The foam height produced by all formulas is the same because the formulation contains foam stabilizers. (19)

**Table 7.** Results of Foam Height Evaluation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Preparations | Day 0 | Day 7 | Day 14 | Day 21 | Day 28 |
| F0 | 3 cm | 3 cm | 3 cm | 3 cm | 3 cm |
| F10% | 3 cm | 3 cm | 3 cm | 3 cm | 3 cm |
| F15% | 3 cm | 3 cm | 3 cm | 3 cm | 3 cm |
| F20% | 3 cm | 3 cm | 3 cm | 3 cm | 3 cm |

The results of testing the antibacterial activity of facial wash with 10%, 15%, and 20% concentration of Red Betel leaves. Shows antibacterial activity with a clear zone around the well. Facial wash with 10% extract concentration provides an inhibition zone of 29 mm, 15% extract concentration provides an inhibition zone of 32.6 mm, 20% extract concentration provides an inhibition zone of 35.3 mm, and the base does not provide an inhibition zone. The higher the extract concentration, the greater the inhibition zone produced. The results obtained are categorized as having strong inhibition because the inhibition zone results are more than 10 mm. No inhibition <6; weak 6-10 mm; moderate 11-20 mm; strong >21-30 mm. The test resulted in a zone of inhibition with a strong inhibition category because the facial wash formulation contains Red Betel leaf extract which is used as an active substance and has antibacterial activity against Propionibacterium acnes bacteria.(6)

**Table 8.** Activity Test Results of Antiacne Facial Wash Preparations of Betel Leaf Extracts

|  |  |  |
| --- | --- | --- |
| Bacteria Name  | Preparations  | Zone of Inhibition (mm) |
| *Propionibacterium acnes* | F0 | - |
| F10% | 29 |
| F15% | 32,6 |
| F20% | 35,3 |

**Conclusion**

Based on the results of the research that has been done Facial Wash from Red Betel leaf extract (Piper crocatum Ruiz & Pav) at 10%, 15%, and 20% extract formulations provide antibacterial activity against Propionibacterium acnes. And from the results of the evaluation of preparations carried out for 28 days, it has met the requirements of SNI 16-4380-1996 Facial Skin Cleanser so that the three formulas are stable, safe, and effective.

**Acknowledgments**

 The authors would like to thank the Directorate of Research and Community Service of the Directorate General of Research and Development of the Ministry of Research, Technology, and Higher Education for the Beginner Lecturer Research (PDP) grant, as well as the Pharmacy Study Program, Faculty of Mathematics and Natural Sciences, Garut University for supporting and facilitating this research.

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