

Development Of Antioxidant Shampoo Formula With Active Ingredients From Greek Yogurt And Green Betel Leaf Extract (*Piper betle* L.)

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Abstract:

Background: Hair is one of the outermost parts of the body that hard to be avoid from sun exposure. Sunlight contains UV-A and UV-B which can damage hair health. One of them is treatment with natural shampoo ingredients that have antioxidant activity. The purpose of this study is to obtain a shampoo preparation of yogurt ingredients and green betel leaf extract that has antioxidant activity with the best concentration.

Materials and Methods: The tools used in this research are digital scales, hot plates, thermometers, pans, Erlenmeyer, beaker glass, measuring cups, tissue, gloves, parchment paper, stir sticks, spatula, horn spoon, dropper pipette, watch glass, mortar and stamper, jar, shampoo container, pH meter, Brookfield viscometer, and UV-Vis spectrophotometry, sonicator, cuvette, micropipette, vial, ruler, stopwatch. The ingredients used in this research are fresh cow's milk, yogurt bacteria or yogurt starter obtained from supermarkets, 70% alcohol green betel leaf extract, sodium lauryl sulfate, Cocamidopropyl Betaine, Na-CMC, citric acid, DMDM hydantoin, acid. ascorbate, DPPH (2,2-diphenyl-1 picryl hydrazyl), methanol PA, ethanol 96% and distilled water.

The method used for making yogurt by fermenting fresh cow's milk, for making shampoo preparations by making five variations including Formula 1 (Yogurt 4%), Formula 2 (Green Betel Leaf Extract 4%), Formula 3 (Yogurt 2% and Green Betel Leaf Extract 2%), Formula 4 (Yogurt 3% and Green Betel Leaf Extract 1%) and Formula 5 (Yogurt 1% and Green Betel Leaf Extract 3%). The physical stability evaluation test of the preparation using the Freezethaw cycling method and room temperature storage was then observed for changes with several test parameters. Antioxidant activity test was also carried out on the shampoo preparation using the DPPH method by measuring the IC₅₀ value using UVVis spectrophotometry

Results : the best concentration between yogurt and green betel leaf extract for shampoo preparation is in formula 3 because it has shampoo preparation test results that fulfill evaluation requirements such as organoleptic tests that remain stable, homogeneity test of homogeneous preparations, viscosity test in the range of 400- 4000cps and foam height test in the range of 1.3-22 cm during room temperature stability test and freezethaw cycling.

Conclusion: The shampoo has very strong antioxidant activity, especially in formula 3 with an IC₅₀ value of 23.66 ppm.

Key Words: Hair, Shampoo, Yogurt, Green Betel Leaf Extract, Antioxidant.

Date of Submission: 18-12-2023

Date of Acceptance: 28-12-2023

I. Introduction

For some people, appearance is something that needs attention, this is because it can improve the visual appearance of both men and women. One visual form that supports appearance is healthy and shiny hair¹. Healthy hair has characteristics such as being black, shiny, thick, not tangled and not falling out. This hair itself is found in almost all parts of the human body and has an aesthetic function that can influence self-confidence. Healthy hair is an important part of routine body care that cannot be separated. The hair health problem that is generally experienced is hair loss, where hair loss is a problem that everyone is worried about because it can cause baldness¹.

It's not just hair loss that causes problems with a person's self-confidence, but also changes in hair color such as gray hair or white hair. The appearance of gray hair can be caused by a lack of melanin pigment, so that when new hair grows it does not get the color of the melanin pigment. This can occur due to genetic factors or due to a decline in hair health with age².

Hair is often referred to as one of the outermost parts of the body that cannot be separated from exposure to sunlight every day. As a result, melanin pigment and hair keratin can be damaged by UV-B rays

from the sun. On the other hand, the interaction of UV-A and endogenous photosensitization can produce free radicals³. Therefore, antioxidant content is very important for healthy hair as a solution to prevent hair damage. This is because antioxidants can rejuvenate and repair damaged hair cells, produce skin tissue that encourages hair growth, and improve blood circulation which hair needs so that hair becomes strong and not dull³. Shampoo is a product used to keep hair clean. So when choosing the right shampoo you have to choose it. When making shampoo, it is generally made from chemicals which can cause problems for the health of the scalp and hair. To overcome this, shampoos with natural ingredients are needed as an alternative to health and cosmetics that have the same effectiveness as those made from chemicals. Green betel leaves are one of the herbal plants that can be used as a natural shampoo.

One of the plants used in traditional Indonesian medicine is betel leaf (*Piper betle* L.). Secondary metabolites such as alkaloids, flavonoids, steroids, terpenes, saponins and tannins are also found in betel leaves (*Piper betle* L.). Plants rich in flavonoid content can be used as antioxidants, anticancer, anti-inflammatory, antihypertensive and antiallergic⁴. Based on research⁵ shows that betel leaves have antioxidant activity. The antioxidant content of green betel leaves is with an IC50 value of 2.0375, which means the antioxidant content is very high⁶. This natural shampoo also adds yogurt, where yogurt is a fermented product that contains various nutrients that are good for health, because it contains vitamins (vitamin B6, vitamin B12, vitamin D and vitamin K), protein, calcium, lactic acid and good bacteria⁷. Based on research⁸, it shows that yogurt contains very high antioxidants, namely an IC50 value of 15.548, where IC50 is a parameter used to determine the effectiveness of samples in inhibiting free radicals.

Based on the description above, it is necessary to develop an alternative pharmaceutical product preparation. The dosage form chosen is a shampoo dosage form with the active ingredients used, namely betel leaves (*Piper betle* L.) and yogurt as antioxidants that can prevent hair damage.

II. Materials And Methods

Tools and materials

The tools used in this research are digital scales, hot plates, thermometers, pans, Erlenmeyer, beaker glass, measuring cups, tissue, gloves, parchment paper, stir sticks, spatula, horn spoon, dropper pipette, watch glass, mortar and stamper, jar, shampoo container, pH meter, Brookfield viscometer, and UV-Vis spectrophotometry, sonicator, cuvette, micropipette, vial, ruler, stopwatch. The ingredients used in this research are fresh cow's milk, yogurt bacteria or yogurt starter obtained from supermarkets, 70% alcohol green betel leaf extract, sodium lauryl sulfate, Cocamidopropyl Betaine, Na-CMC, citric acid, DMDM hydantoin, acid, ascorbate, DPPH (2,2-diphenyl-1 picryl hydrazyl), methanol PA, ethanol 96% and distilled water.

The research, which was carried out using experimental research methods, was carried out in two places, namely the Pharmaceutical Technology Laboratory, Bhakti Kencana University, Bandung, Jalan Soekarno-Hatta No. 754, which will be a research location for making shampoo preparations and evaluating shampoo preparations. To make yogurt, it is done at the Ayra Mini Yogurt Laboratory, Jalan Pasir Honje. The stages in the research or data collection are, making yogurt using the fermentation method of fresh cow's milk which is then incubated for 24 hours. The yogurt produced is made from good bacteria, namely *Lactobacillus acidophilus*, *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, and *Bifidobacterium*. Before using yogurt, a yogurt evaluation test is required in the form of an organoleptic and pH test. The betel leaf extract is obtained from an extract seller in the city of Yogyakarta with the name Lansida Herbal Technology which is located at Jl. Karanglo No. 519 Bumen KG III Purbayan District. Kotagede Yogyakarta City, Special Region of Yogyakarta (55173). Then the shampoo formula was made in five variants, where in each variant a different ratio was made between yogurt and betel leaf extract. The first formula (F1) has a yogurt concentration of 4% without the addition of green betel leaf extract. The second formula (F2) contains 4% green betel leaf extract without the addition of yogurt. The third formula (F3) is yogurt and green betel leaf extract (2:2). Fourth formula (F4) yogurt and green betel leaf extract (3:1). Fifth formula (F5) yogurt and green betel leaf extract (1:3). Do not forget to also test the shampoo preparation to evaluate the physical stability of the preparation, namely, using the Freezethaw cycling method and room temperature storage and then observe the changes using test parameters such as organoleptic test, homogeneity test, pH test, viscosity test, foam height test and stability test. Antioxidant activity tests were also carried out on shampoo preparations using the DPPH method with the aim of determining the effectiveness of the samples on a scale to inhibit free radicals by measuring the IC50 value to determine the levels and properties of antioxidants.

III. Results

Yogurt Production

The resulting yoghurt was tested organoleptically, namely the results showed that the yoghurt had a thick liquid form, sour taste, white color and a typical yoghurt aroma. A pH test was also carried out on the

yogurt that had been made, which had a pH value of 4.50, which means that the yogurt made met the pH requirements for yogurt based on SNI between 3.8-4.5.



Figure.1 Greek Yogurt

Green Betel Leaf Extract

Green betel leaf extract was tested organoleptically and pH tested. From the organoleptic test results, it was found that green betel leaf extract was black in color, had a distinctive aroma and had a bitter taste. For the pH test, the green betel leaf extract obtained had a pH value of 6.21.



Figure 2 .Green Betel Leaf Extract

Shampoo Preparations

This shampoo formulation was made using the results of initial base optimization. The results of the base optimization obtained the best results for making shampoo preparations with the addition of the active ingredient yogurt and green betel leaf extract (*Piper betle* L.).



Figure 3.Shampoo preparatios from various formula

Results of making shampoo preparations

Physical Evaluation Test of Preparations

Based on the results carried out in the physical evaluation tests at room temperature and Freezethaw cycling, it was found that the results for preparations F0, F1, F2, F3, F4, and F5 in the first organoleptic test on shampoo preparations remained stable in terms of color, aroma and shape. The two homogeneity tests for homogeneous shampoo preparations did not contain particles that were not evenly mixed. The three pH tests on shampoo preparations meet the shampoo pH range requirements according to SNI 06-2692-1992, namely 5.0-9.0 and within the skin pH range, namely 4.5-6.5. The four viscosity tests on shampoo preparations meet the

requirements within the viscosity value range according to SNI, namely 400-4000 cPs. Finally, the foam height test of the shampoo preparation met the foam height requirements according to ⁹, namely 1.3 – 22 cm.

Table 1. Result of Shampoo evaluations

Parametres	Fulfilled requirements	Do not filled requirements
Organoleptic	✓	-
Homogeneity	✓	-
pH	✓	-
Viskocity	✓	-
Bubble height	✓	-

Antioxidant Activity Test

From the results table data, the IC50 values for shampoo preparations have varying results, this can be caused by differences in the concentration of the active substances used. If we look at Formula 0, it has weak antioxidant activity because Formula 0 does not use active ingredients, only the base and Formula 0 is a positive control. Meanwhile, formula 1 which was added with the active substance 4% yogurt had strong antioxidant activity, namely having an IC50 value of 77.72 ppm, formula 2 which was added with the active ingredient 4% green betel leaf extract had very strong antioxidant activity, namely having an IC50 value of 27.12 ppm, formula 3 which was added with 2% yoghurt active substance and 2% betel leaf extract had very strong antioxidant activity, namely IC50 value of 23.66 ppm, formula 4 which was given 3% yoghurt active substance and 1% betel leaf extract had very strong antioxidant activity, namely an IC50 value of 33.36 ppm, and for formula 5 which was added with the active ingredient 1% yogurt and 3% green betel leaf extract, it had a very strong antioxidant activity, namely an IC50 value of 38.45 ppm. So the strongest antioxidant activity is in formula 3 which contains the same concentration of active substances. This can happen because the active substance content between yogurt and green betel leaf extract is in the same concentration and is appropriate so that it can make the antioxidant activity very strong.

Table2.Result of Antioxidant Activity

Sample	IC50 value (ppm)	Category
Ascorbic Acid	6.19	Very Strong
Formula 0	507.01	Weak
Formula 1	77.72	Strong
Formula 2	27.12	Very Strong
Formula 3	23.66	Very Strong
Formula 4	33.36	Very Strong
Formula 5	38.45	Very Strong

IV. Conclusions

1. The best concentration between yogurt and green betel leaf extract for shampoo preparation is formula 3 with the same concentration (2% yoghurt and 2% green betel leaf extract)
2. The shampoo preparation that has been made meets the evaluation requirements such as the organoleptic test which remains stable, the homogeneity test of the homogeneous preparation, the viscosity test in the range of 400-4000cps and the foam height test in the range of 1.3-22 cm during the room temperature stability test and freezethaw cycling.
3. Shampoo preparations that have been made with the active ingredients yogurt and green betel leaf extract have very strong antioxidant activity, especially in formula 3 which has an IC50 value of 23.66 ppm.

Acknowledgement

Thankyou for Community Service Research Institute at Universitas Bhakti Kencana, Indonesia for funding this project 2023

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