

Hedonic Test of Sunscreen Cream Combination of Corn Cob Extract (*Zea mays L*) and Robusta Coffee Bean Extract (*Coffea Canephora Pierre Ex A. Froehner*)

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ABSTRACT

Research was carried out to see moisturizing ability, preference level, and safety of sunscreen cream combination of corn cob extract and Robusta coffee bean extract in W/O (formulation cream A) and O/W (formulation cream B) type base. Moisturizing test involved 6 panelists divided into 3 groups. Panelists skin hydration level was assessed on days 0, 7, 14, and 28 using skin analyzer. Hedonic test involved 30 panelists that provide assessments to color, aroma, texture, and comfort of use of both creams by filling out questionnaire. Irritation test involved 10 panelists using open patch test for 3 days. Results of 28 days of usage showed increased panelist skin hydration. Where significancy was shown between usage time and hydration level ($p = 0,003$), whereas effect of different treatments on hydration level didn't show significancy ($p = 0,129$). Each sensory aspect of formulation cream B scored higher than those of formulation cream A. Where significant differences were showed between average assessments of texture ($p < 0,001$), color ($p = 0,002$), and comfort of use ($p = 0,003$). Both creams didn't show existence of erythema or edema on any panelists skin. This Research concludes both creams improve skin hydration from dehydration category to normal category from day 7 onward. Formulation cream B has better texture, color, and comfort of use that are preferred by panelists, which consecutively scored like, neutral, and between neutral and like. Meanwhile, aroma aspect of both formulations scored between neutral and like. Both creams also didn't cause irritation to panelists skin.

Keywords: Cream Combination, Corn Cob Extract, Robusta Coffee Bean Extract, Hedonic Test

I. INTRODUCTION

Exposure to ultraviolet (UV) radiation from sunlight is a major extrinsic factor causing skin aging [1]. The main manifestations of photoaging include wrinkles,

dyspigmentation and textural changes. Premature skin aging can also reduce skin moisture, resulting in dry skin [2]. These can lead to a sense of dissatisfaction with physical appearance, which can also have a psychological impact [3]. Sunscreen is a

cosmetic preparation that serves to protect the skin from the adverse effects of UV rays through reflection or absorption of UV rays [4]–[6]. Regular use of sunscreen plays an important role in preventing photoaging while restoring exposed skin [7]. A study of 32 women who were asked to use a broad-spectrum sunscreen with an SPF value of 30 regularly for 52 weeks showed that there was significant recovery in all manifestations of photoaging [3]. Corn cobs and Robusta coffee beans have potential as sunscreen ingredients. The combination of their ethanol extracts showed antioxidant activity with an IC50 value of 30.2 ppm (very strong) [8]. Our previous research showed that the combination of 10% corn cob extract and 15% Robusta coffee bean extract was the combination with optimum sunscreen effect with IC50 value of 97.34 ppm (strong antioxidant) and SPF value of 37 (ultra protection) Previous research has also shown that the combination of 10% corn cob extract and 15% Robusta coffee bean extract in type W/O and O/W cream formulations has good physical stability. Where both creams have met the requirements of the organoleptical test, homogeneity, pH, viscosity, spreadability, and stickiness [9].

Apart from having a protective effect against UV rays and good physical stability, sunscreen cream preparations must also be liked by consumers [10]. A good level of liking will encourage regular use. This is important because improper use of sunscreens can reduce their protective benefits. The level of consumer liking for cosmetics is assessed from the sensory aspects during use. This level of liking can be used as a basis for improving the quality of sunscreens made [11]. Based on the explanation above, the researcher conducted a skin moisture test, liking test, and human irritation test on the formulation of sunscreen cream with a combination of corn cob extract (10%) and Robusta coffee bean extract (15%) in W/O and O/W bases.

II. METHODS AND MATERIAL

The type of research conducted was laboratory experimental. This research was carried out in the phytochemical laboratory, pharmaceutical laboratory, and pharmaceutical technology laboratory at Poltekkes Kemenkes Jakarta II. The study was conducted from January to October 2022. The equipment used were digital scale (Acis AD-600i), water bath (Labtech), rotary evaporator (Buchi Rotavapor R-300), microscopes, viscometers (Brookfield RV), pH meters (Hanna HI 8424), ovens (Memmert Un55), skin analyser, and glassware (Pyrex). The materials used are corn cobs and Robusta coffee beans obtained from Bogor plantations and determined at the Research Center for Biosystematics and Evolution of BRIN (National Research and Innovation Agency) Cibinong. The essential ingredients of the cream are stearic acid, glycerin, sodium tetraborate, triethanolamine, cera alba, cetaceum, adeps lanae, nipasol, nipagin, and aqua dest. Pro analyst materials (Merck) for extract identification.

A. Cream Formulation

The sunscreen cream formulation contains 10% natural active ingredients of corn cob extract and 15% Robusta coffee beans, using two different cream bases, namely type W/O and type O/W both formulations used for this study are formulations with physical properties and stability that meet the requirements, which has been proven in previous studies [9]

Table 1. Cream Formulation

Formulation A (Tipe W/O)	Formulation B (Tipe O/W)
Corn cob extract 10 %	Corn cob extract 10 %
Robusta coffee bean extract 15 %	Robusta coffee bean extract 15 %
Cera alba 1 g	Stearic acid 7.068 g
Cetaceum 4 g	Glycerin 4.978 g
Adeps lanae 30 g	Na. tetraborate 0.124 g

Nipasol 0.02 %	Triethanolamine 0.498 g
Nipagin 0.12 %	Aqua 37.332 g
Aqua ad 50	Nipagin 0.12 % Nipasol 0.02 %

The oil and water phases are heated separately in a water bath at a temperature of 70-75°C. The two melted steps were mixed at 70°C with stirring until the temperature decreased and a homogeneous base was formed. The two extracts and preservatives were combined until homogeneous with a base at 35°C.

B. Physical Evaluation and Cream Stability

1) Organoleptic Test

This test examines the finished cream preparations using the five senses, including color, smell, texture, and shape [3].

2) Homogeneity Test

The test is carried out by applying 50 mg of cream to a glass object which will then be viewed under a microscope with a magnification of 10 times [12].

3) Viscosity Test

The test was carried out using a Brookfield viscometer with spindle number 6 or 7, which was set to 50 rotations per minute (rpm). This measurement was repeated 3 times [3], [13], [14].

4) Test pH

The test was carried out using a calibrated Hanna HI 8424 pH meter. The electrode from the pH meter is immersed in the preparation, then let stand until it shows a stable pH value. The test was repeated 3 times [3].

5) Power Spread Test

The test was carried out by placing a sample of 0.5 grams in the middle of an inverted petri dish, then placing another petri dish on top. On top of it, added 50 grams of ballast and let it stand for 1 minute. The process is repeated so that the additional load reaches 500 grams. Then the diameter of the cream spread is measured [9].

6) Stickiness Test

The test is carried out by placing 0.5 grams of sample on the hand, then rubbing it until the cream disappears. Count the time it disappeared with a stopwatch, then record the time.

7) Stability Test

The test was carried out with the Cycling test; namely, the sample was stored at $4 \pm 2^\circ\text{C}$ and 40°C for 24 hours each. This treatment is called 1 cycle. After 6 cycles of treatment, all physical evaluations were carried out on the samples. The results before and after the 6 cycles of treatment were compared [15].

C. Skin Moisture Test

The test involved 6 panelists with the criteria of a healthy woman, aged between 20-30 years, no history of allergies, and willing to be a volunteer. Panelists were divided into three groups, namely:

- 1) Group I: 2 people were given the base and cream from formulation A
- 2) Group II: 2 people given base and cream from formulation B
- 3) Group III: 2 people were given cream that has been registered with BPOM.

The initial moisture content (day 0) of each panelist was measured with a skin analyzer. Panelists were then asked to apply the cream evenly on the back of the hand. The application was done twice a day for 28 days. The moisture content of each panelist was measured on days 7, 14, and 28 [16].

D. Hedonic Test

The test involved 30 panelists with the criteria of being female, 18 years of age and above, in good health when conducting the test, having used cosmetics before, not having allergies to the ingredients in the formulation, and willing to volunteer [17]. All panelists were asked to apply sunscreen cream on the shoulder of the hand. Afterwards, the panelists will be asked to fill out a

questionnaire to provide an assessment of the sensory aspects of both formulations. The sensory aspects assessed include color, aroma, texture, and comfort of use. The questionnaire used a Likert scale of 1-5, consisting of 5 levels of assessment, namely: very like (5), like (4), neutral (3), dislike (2), and very dislike (1) [10].

E. Irritation Test

The test involved 10 panelists with the criteria of being female, aged between 18-21, in good health, no history of allergy, and willing to volunteer. The method used was an open patch test by applying the cream preparation 3 times a day in an interval of 8 hours for 3 days on the skin of the inner forearm with an area of 2.5 x 2.5 cm. Observations of erythema and edema that occurred were made at the 24th, 48th, and 72nd hours after application [18]. Observations were scored based on the severity of erythema and edema (complete scoring information can be seen in table 2).

Tabel 2. Cream irritation test

Type of Irritation		Skor
Erythema	No erythema	0
	Very mild erythema (barely visible)	1
	Erythema Mild erythema (clearly demarcated)	2
	Moderate erythema	3
	Severe Eritema	4
Edema	No edema	0
	Very mild edema	1
	Mild Edema	2
	Moderate Edema	3
	Severe Edema (beet red) to slightly crusted	4

III. RESULTS AND DISCUSSION

A. Physical Evaluation and Cream Stability

Table 3. Physical Stability Before Cycling Test

Evaluation Test	Formulation A (Tipe W/O)	Formulation B (Tipe O/W)
Organoleptic		
Color	Dark brown	Chocolate
Smell	Typical coffee	Typical coffee
Textur	Gentle	Very soft
Form	Half solid	Half solid
Homogeneity	homogeneous	homogeneous
pH Test	5,05	6,04
Viscosity Test	29.750	6.150
Spreadability Test	4,400	4,35
Stickiness Test	298,00	198,67

Table 4. Physical Stability After Cycling Test

Evaluation Test	Formulation A (Tipe W/O)	Formulation B (Tipe O/W)
Organoleptic		
Color	Dark brown	Chocolate
Smell	Typical coffee	Typical coffee
Textur	Gentle	Very soft
Form	Half solid	Half solid
Homogeneity	homogeneous	homogeneous
pH Test	4,69	5,37
Viscosity Test	24.400	5.600
Spreadability Test	4,485	5,385
Stickiness Test	234,33	198,00

Both formulations met all evaluation and physical stability requirements as indicated by the results of the organoleptic test with no change in color, odor, texture and shape. The cream looked homogeneous when tested with a microscope. The pH value before and after the cycling test is still within the normal pH range of sunscreen preparations (4.5 - 6.5) [19]. The viscosity value after the cycling test is still within the standard viscosity of sunscreen preparations (2,000 - 50,000 cps) [14]. The results of the spreadability test after the cycling test are still within the requirements (>4 cm). The results of the adhesion test after the cycling test are also still within the requirements of a good cream preparation (2-300 seconds) [19].

B. Skin Moisture Test

Moisture content observation results with a skin analyzer on day 0 of the base and cream A and B showed 21% to around 30%, indicating dehydrated skin. After the use of day 7 to day 28, the base and cream A and B increased the moisture content to 38% to 48%, indicating normal skin moisture. One-way repeated measures ANOVA analysis of the treatment of cream A, cream B, and control showed significant differences in moisture content from day 0 to day 28 (p = 0.003), while the effect of treatment type on moisture content was not significant (p = 0.129).

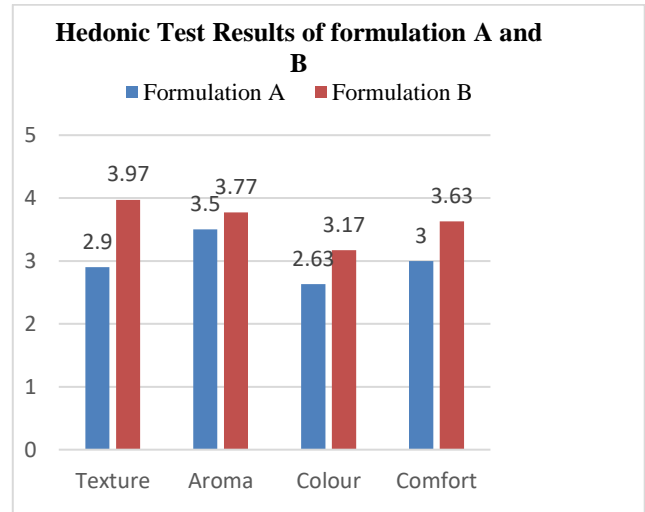
Tabel 3. Skin Moisture Content Observation Results

Preparation	Observation day- (%)			
	0	7	14	28
Base A	21,55	38,50	47,65	48,55
Formulation A	27,55	40,95	43,95	41,90
Base B	21,55	41,65	43,65	46,35
Formulation B	32,50	40,10	40,35	45,00
Control	38,90	45,60	49,40	
				56,90

C. Hedonic Test

Formulation B cream scores in the range of 3.17-3.97 showed all sensory aspects were in the neutral to like category. Formulation A cream scores in the

range of 2.63-3.50 where texture, aroma, and comfort are between the neutral and like categories, while color is between dislike and neutral. The hedonic test results showed that the scores of all sensory aspects of formulation B cream were higher than formulation A cream.



The average assessment of the texture aspect shows that formulation B cream is more desirable than formulation A cream. Where formulation B has an average score of 3.97 which is included in the very like category. While formulation A has an average score of 2.90 which falls into the neutral category. Friedman test analysis showed a significant difference between the average assessment of the texture aspects of the two formulations (p < 0.001).

The average assessment of the aroma aspect showed an average score of 3.5 for formulation A and 3.77 for formulation B, both categories were between neutral and like. Friedman test analysis also showed there was no significant difference between the average assessment of the aroma aspects of the two formulations (p = 0.108).

The average color aspect assessment showed that formulation B cream was more desirable than formulation A cream. Friedman test analysis showed a significant difference between the average assessment of the color aspects of the two formulations (p = 0.002). Formulation B has an average score of 3.17 which falls into the neutral

category. While formulation A has an average score of 2.63 which is between the dislike and neutral categories. This is due to the brown color of formulation A cream is darker than formulation B cream. The color aspect in both formulations obtained the lowest average score compared to other aspects of the assessment, this shows that the color aspect of the preparation still has to be improved. In addition, the panelists were also of the opinion that the color produced after the cream was applied was unsatisfactory.

The average assessment of the comfort aspect of use showed that formulation B cream was more desirable than formulation A cream. Friedman test analysis showed a significant difference between the average assessment of the comfort aspect of the two formulations ($p = 0.003$). Formulation B had a mean score of 3.63 which was between the neutral and like categories. While formulation A had an average score of 3 which fell into the neutral category. Comfort is related to viscosity, cream that is that is too hard can interfere with the comfort of use [14]. The viscosity of formulation A cream is quite high, causing panelists to prefer formulation B cream. This difference is caused by the different base types between the two formulations. Formulation A is type A/M and formulation B is type M/A.

D. Irritation Test

Observation of the panelists' skin condition after the 24th, 48th, and 72nd hours of use indicated that there was no erythema or edema in all panelists. so that the test cream can be categorized as safe.

IV. CONCLUSION

Cream formulations A and B are able to improve skin moisture from the dehydrated category to the normal category from day 7 onwards. Formulation B cream has a texture, color, and comfort of use that is preferred by panelists, which successively obtained a rating of like, neutral, and between neutral and like.

While the aroma aspect of the cream of both formulations obtained a rating between neutral and like. Both creams also did not cause irritation to the skin of the panelists. Both formulations A and B are also safe to use because they do not cause irritation to the panelists.

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