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Research Article

Formulation of Green Robust Coffee Bean Extract (Coffee Canephora) in Serum Preparation Using Gelling Agent Hidroxy Propyl Methyl Cellulose

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Abstract.
Robusta green coffee bean extract (*Coffee canephora*) contains chlorogenic acid, a polyphenolic compound that functions as an antioxidant. It acts by inactivating the oxidation reaction to prevent free radicals from forming. In this study, robusta green coffee bean extract was made in serum preparations because the serum contains a high concentration of active ingredients. It can immediately overcome skin problems and provide a relaxing effect when applied. This study aimed to determine the effect of varying the levels of extracts of robusta green coffee beans (*Coffee canephora*) at 2.5%, 5%, and 7.5% on the physical and chemical characteristics (organoleptic, pH, dispersibility, homogeneity and viscosity) and the physical stability in serum preparations with an HPMC 0.5% gelling agent. The study was initiated by making a serum formulation with variations in the level robusta green coffee bean extract levels of 7.5%. Organoleptic and homogeneity tests were observed. The pH, dispersibility, and viscosity tests were analyzed using the One-way Anova data analysis methods. The stability test was carried out using the Freeze-Thaw method. The results of the data before and after the stability test were analyzed using the Paired- Sample T Test. Increasing levels of robusta green coffee bean extract in serum had an effect on the results of the physical and chemical characteristics. The intensity of the color is got sharper, the spreadability increased, while the pH and viscosity decreased. The results of the Freeze-Thaw stability test during the 12 days of storage did not affect the pH value and dispersion. So, preparation was stable and safe for use on the skin.

Keywords: Robusta green coffee bean extract (*Coffee canephora*), serum, physicochemical characteristics, and stability.

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1. INTRODUCTION

The skin is an organ that covers the outer surface of the body and includes the widest and largest organ of the body to protect the internal organs from the external environment such as weather or climate [1]. The skin functions to protect the body from external environmental influences, such as changes in temperature or climate,

disease organisms, and ultraviolet sunlight. The factors that can cause skin problems are exposure to ultraviolet (UV) rays and free radicals.

Free radicals and ultraviolet rays can cause damage to the skin such as pigmentation, premature aging, skin cancer, erythema, loss of skin elasticity, and skin looks reddish. Free radicals that cause damage to the skin can be inhibited by the presence of antioxidant compounds. Antioxidants are compounds that inhibit and suppress oxidation reactions by binding to free radicals [2].

Robusta green coffee beans are one of the plants that have antioxidant activity. Robusta green coffee beans contain polyphenolic compounds, namely chlorogenic acid and caffeic acid. Chlorogenic acid contained as much as 90% of the total phenol of Robusta coffee beans. Polyphenol compound itself including a source of antioxidants [3]. The results showed that the ethanol extract of Robusta coffee beans contained very strong antioxidant levels with IC5040.9923 [4].

Serum is one of the topical dosage forms used for facial skin care. The advantage of serum preparations is that it has a low viscosity and contains a high concentration of active ingredients so that it is more quickly absorbed by the skin, provides a comfortable effect, and is easy to spread when applied and helps overcome problems on facial skin [5].

Therefore, robusta green coffee beans (*Coffee canephora*) in this study will be made in the form of serum dosage forms. Furthermore, characteristic tests and stability tests were carried out. The characteristic test includes organoleptic test, pH, homogeneity, dispersion, and viscosity. While the stability test using the method *freeze thaw*.

2. METHODS

2.1. Tool

PH meter,*brookfield viscometer*, scattering equipment,*analytical balance*, *climate chamber*, and refrigerators.

2.2. Ingredient

Robusta green coffee beans obtained from Tulungagung, East Java were then extracted by UPT Laboratory of Herbal Materia Medica Batu, HPMC (Ashland, United States of

America), Sodium metabisulfite (Merck, Germany), Phenoxyethanol (Clariant, Deutschland), Aquadest (PT. Smart- Lab, Indonesia), and Glycerin (P&G Chemicals Asia, Singapore).

2.3. Preparation of Robusta Green Coffee Bean Extract Serum Preparation

Preparation of serum preparations of robusta green coffee bean extract (Coffee *canephora*) was replicated 3 times. Started by developing HPMC in the water (Mix 1). After that, phenoxyethanol was mixed with glycerin (Mixture 2). Then Mix 2 is put into Mix 1, namely the gelling agent, stir until homogeneous. Dissolved sodium metabisulfite in water, then added to the mixture, stirred until homogeneous. Next, add robusta coffee bean extract, stir until homogeneous. Add the remaining aquadest and stir until serum is formed.

TABLE 1: Formulation of Robusta Green Coffee Bean Extract Serum Preparations.

Ingredient Function		Formula (%)		
		F1	**F2**	**F3**
Seed Extract	Ingredient			
Green Coffee	active	2.5	5	7.5
Robusta				
HPMC	Gelling	0.5	0.5	0.5
	agent			
Phenoxy-	Preservative	1	1	1
ethanol				
Sodium Metabisulfite	Antioxidant	0.5	0.5	0.5
Glycerin	Humectants	15	15	15
Aquadest	Solvent	Ad 100	Ad 100	Ad 100

2.4. Characteristic Test Evaluation

2.4.1. Organoleptic Test

Organoleptic tests are carried out to observe the physical appearance of the preparation visually including the smell, shape, and color of the preparations that have been made [6].

2.4.2. Homogeneity Test

The homogeneity test aims to find out the ingredients in the formula are well mixed. This test is carried out by smearing the preparation on a transparent slide, then observing a homogeneous arrangement. A good preparation does not contain coarse grains [7].

2.4.3. pH test

The pH test aims to determine the the acidity level of the preparation so as not to cause irritation to the skin. Evaluation of the pH of the preparation using a pH meter. The pH device was previously calibrated first, then immersed in the preparation. The pH of the preparation will be seen on the pH meter [6]

2.4.4. Viscosity Test

Viscosity test is carried out to determine the flowability or the level of viscosity of a preparation. This test uses a viscometer Brookfield LV where is speed and spindle set first. The preparation is put into a container then spindle that has been installed is lowered until it is immersed in the preparation.

The viscosity value (cPs) will be seen on the Brookfield Viscometer tool [7]. A good viscosity range in serum preparations is 230 – 1150 cPs [8].

2.4.5. Spreadability Test

Spreadability test aims to determine the ability to spread a preparation on the skin surface when used. The test was carried out by weighing the serum preparation as much as 0.5 g, then placing it in the middle of a scaled transparent round glass. On the top surface, the serum was placed in another transparent round glass and a weight of 150 g, allowed to stand for one minute, then the diameter of the distribution was recorded. Good dispersion of gel preparations ranges from 5-7 cm [9].

2.4.6. Stability Test Evaluation Freeze Thaw

Serum stability testing was carried out by placing the preparation in a vial and then stored in a refrigerator at 4°C for the first 24 hours, then for the next 24 hours it was

stored in an oven at 40°C, this evaluation is one cycle. Evaluation of the stability of serum preparations was repeated for 6 cycles or for 12 days [10].

2.5. Data Analysis

Analysis of physical and chemical characteristics examination including organoleptic, and homogeneity was carried out descriptively. Test of physical and chemical characteristics which include viscosity, dispersion, and pH using data analysis methods One-way Anova continue with test Honestly Significant Difference (HSD).

Analysis of examination of serum preparation data on stability test freeze thaw using analytical method dependent t test or paired sample t test.

3. RESULTS AND DISCUSSION

3.1. Characteristic Test

3.1.1. Organoleptic

Figure 1: Results of Organoleptic Observations of Serum Preparations.

The results of the serum preparation of robusta green coffee bean extract from each formula have almost the same color, aroma, and shape between the formulas, namely having a yellow color, distinctive aroma, and slightly thick liquid form. The increase in the level of the active ingredients used the sharper the color intensity.

Table 2: Results of Homogeneity of Serum Preparations.

	Formula	Homogeneity
F1	Replication 1 Replication 2	Homogeneous Homogeneous
	3 replications	Homogeneous
F2	Replication 1 Replication 2	Homogeneous Homogeneous
	3 replications	Homogeneous
F3	Replication 1 Replication 2	Homogeneous Homogeneous
	3 replications	Homogeneous

3.1.2. Homogeneity

From the results of the examination of the homogeneity of the serum preparation of robusta green coffee bean extract in each formula, namely homogeneous where there are no coarse grains or insoluble particles on the glass.

3.1.3. pH

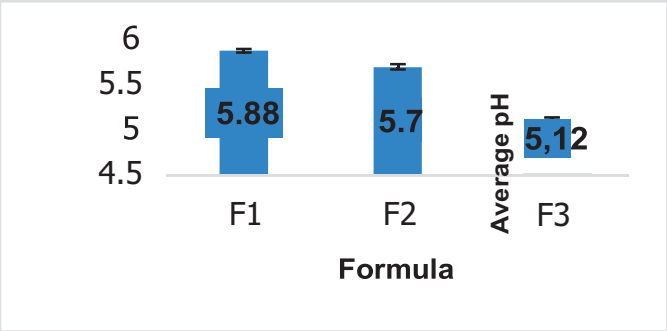

Figure 2: Serum Preparation Ph Measurement Results.

From the results above, the Ph values obtained are formula 1 (5.88 ± 0.02), formula 2 (5.70 ± 0.03), and formula 3 (5.12 ± 0.02). The higher the extract content used, the lower the Ph value. The decrease in Ph occurred due to the presence of polyphenolic compounds in robusta green coffee bean extract, namely chlorogenic acid which is acidic. Results of data analysis *One- way Anova* obtained that is significant value (0.000) < (0.05), so that there is a significant difference in the addition of variations in the levels of robusta green coffee bean extract. Continued with the test *Tukey HSD*. The results can be seen in table 3.

Table 3: Statistical Analysis Results Tukey HSD Ph test.

	Formula I	Formula II	Formula III
Formula I	+	-	+
Formula II	-	+	+
Formula III	+	+	+

3.1.4. Viscosity

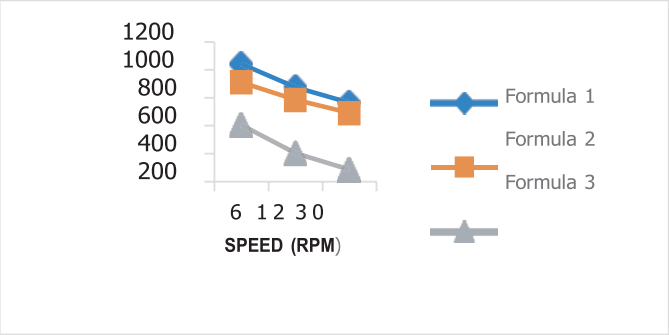

Figure 3: Graph of Serum Preparation Viscosity Test Results.

Based on the results above, the three formulas experienced a decrease in the viscosity value. This decrease is due to differences in extract levels, the higher the levels used, the more liquid the preparations so that the viscosity results get smaller. The flow properties obtained are:non-newtonianpseudoplastic because it is influenced by the decreasing viscosity value. So that the greater the speed of viscosity used, the results obtained will decrease (liquid), conversely the smaller the speed used, the results obtained are high viscosity (thick) [11]. The results obtained from the data One-way Anovai.e. significant value (0.015) < (0.05), so there is a significant difference. Continued with the test Tukey HSD. The results can be seen in table IV.

Table 4: Statistical Analysis Results Turkey HSD Viscosity.

	Formula I	Formula II	Formula III
Formula I	-	-	+
Formula II	-	-	+
Formula III	+	+	-

3.1.5. Spreadability

Based on the above results, each formula has an increasing dispersion, because the viscosity results obtained previously in each formula have decreased, where the smaller the viscosity, the higher the dispersion power, on the other hand, the higher the viscosity,

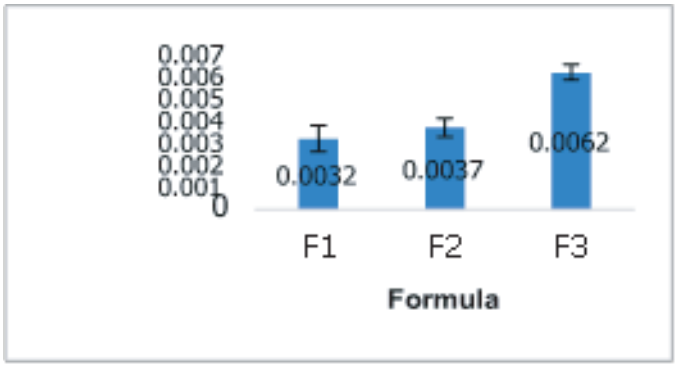

Figure 4: The Result of the Spreading Power of Serum Preparations.

the lower the dispersion [11]. Results of data analysis One-way Anovai.e. significant value (0.000) <(0.05), so there is a significant difference. Continued with the test Tukey HSD. The results can be seen in table 5.

TABLE 5: Results of Statistical Analysis of Tukey HSD Spreading Power.

	Formula I	Formula II	Formula III
Formula I	+	-	+
Formula II	-	+	+
Formula III	+	+	+

Evaluation Stability test

3.1.6. Organoleptic

Figure 5: Results of Organoleptic Observation of Serum Preparation Stability Test.

Based on the results observation from the organoleptic analysis above, it can be seen that the three formulas were stored for 6 cycles or 12 days at a temperature of 40± 2℃ and temperature 4± 2℃preparation remains stable. This is indicated by the absence of

changes in color, texture or odor in the preparation and does not undergo separation of the two phases during storage.

3.1.7. Homogeneity

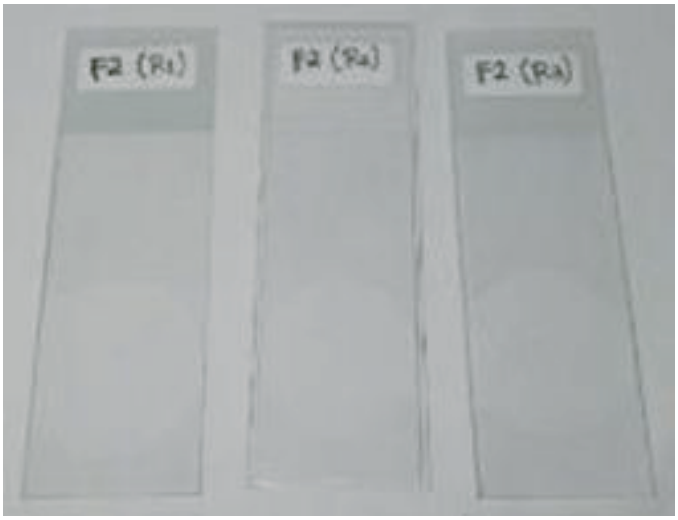

Figure 6: Results of Homogeneity of Serum Preparation Stability Test.

Based on the above observations on each formula during storage 6 cycles at a temperature of 40± 2℃and temperature 4± 2℃indicates the absence of coarse grains or insoluble particles on the glass object glassso that all preparations were homogeneous before and after the stability test. Preparations can be declared stable.

3.1.8. Ph

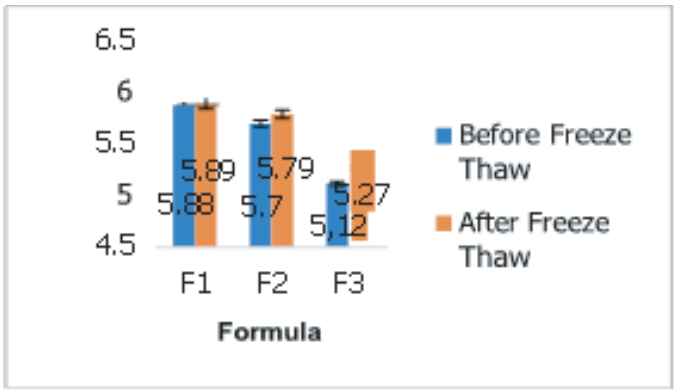

Figure 7: Results Comparison Checking the Ph of Serum Preparations Before and After Stability.

Based on results picture from the histogram above, it can be seen that the Ph of the serum preparation of green coffee bean extract after stability testing has changed. But

the Ph value is still in the good skin Ph range of 4.5 – 6.5 so that the serum preparation is stable and safe to use [6]. Test data resultsPaired-Sample T Test namely the significant value of formula 1 (0.729> 0.05), formula 2 (0.074> 0.05), and formula 3 (0.071> 0.05) it can be concluded that the storage temperature of serum preparations has no effect on the Ph value.

3.1.9. Spreadability

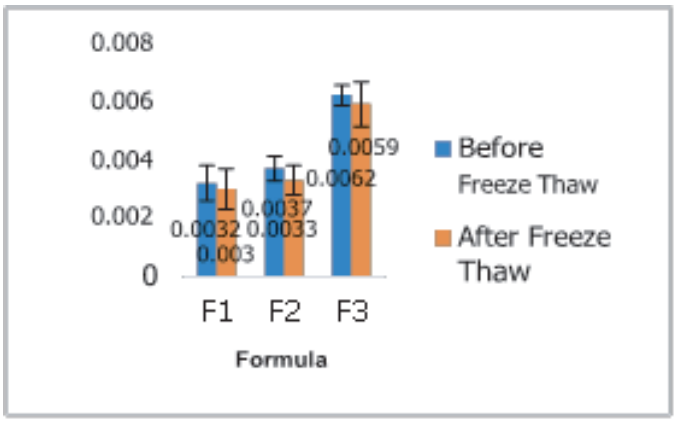

Figure 8: Results Comparison Examination of the Spreadability of Serum Preparations Before and After Stability.

It can be seen the value of dispersion from before and after the stability test Freeze Thaw. The results obtained from the test Paired-Sample T Test namely the significant value of formula 1 (0.742 > 0.05), formula 2 (0.529 > 0.05), and formula 3 (0.446 > 0.05) it can be concluded that the storage temperature of serum preparations has no effect on the dispersion value.

4. CONCLUSION

Differences in variation of levels in robusta green coffee bean extract (*Coffee canephora*) which is increasing in serum preparations affect the results of the organoleptic physic-ochemical characteristics test, namely the sharper color intensity, decreasing viscosity and pH, and increasing dispersion. In addition, there are significant differences in the results of pH, dispersion, and viscosity. The results of the stability test using the method Freeze Thaw, the value of dispersion and pH of serum extract preparations There was no significant difference in robusta green coffee beans in all formulas. So that it can be declared a stable preparation after a stability test is carried out. It is hoped that there

will be further research such as acceptability testing which is used to determine the level of consumer preference for the preparation.

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