



Optimization of Antioxidant Gel Formula Green Tea Leaf Extract (*Camellia sinensis* L.) With Virgin Coconut Oil (VCO)

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Abstract. Gels containing antioxidants can be topical preparations to ward off free radicals. One natural ingredient with a high antioxidant content is green tea (*Camellia sinensis* L.). Green tea contains polyphenols consisting of several chemical compounds such as flavanols, flavandiols, flavonoids, and phenolic acids. The virgin coconut oil in the gel can also be used as an antioxidant because it contains antimicrobial lauric acid, caprylic acid, and tocopherol, which functions as an antioxidant. This research aims to determine the antioxidant activity in green tea extract gel with different concentrations of virgin coconut oil. This research is an experimental laboratory by making green tea extract gel with virgin coconut oil. Gel evaluation was carried out using physical tests and antioxidant activity tests. The physical examination of the gel consists of an organoleptic test, homogeneity test, pH test, spread ability test, stretchability test, and viscosity test. Test the antioxidant activity of the gel using the DPPH method. The data analysis used was SPSS with the One-Way Anova method. The test results showed that giving different concentrations of virgin coconut oil to Formula I, Formula II, Formula III, Formula IV, and Formula V on the gel had antioxidant activity with IC₅₀ values of 84,509 ppm, 121,213 ppm, 75,804 ppm, 63,405 ppm respectively, and 47,316 ppm. The results of statistical analysis show that differences in the concentration of virgin coconut oil in the gel affect the preparation's physical evaluation value and antioxidant activity, with results showing that the significance value obtained is <0.05.

Keywords: Gel, Antioxidant, Green Tea Leaves, Virgin Coconut Oil.

1 Introduction

Skin is the body's primary protector from ultraviolet (UV) rays. Ultraviolet is the main factor that can cause premature aging (Anggraini, 2018). Currently, many moisturizing preparations are available on the market, especially those made from plant ingredients. One preparation that can moisturize the skin is a gel preparation (Tristantini

et al., 2016). The gel is generally a semi-solid preparation that is clear and translucent (Melani & Intelekt, 2021). Usually, gel preparations in the form of cosmetics on the market can include shampoo, perfume, toothpaste, hair, and skin care preparations (Anindhita & Oktaviani, 2020). Gels containing antioxidants in topical preparations can help ward off free radicals.

One natural ingredient with relatively high antioxidant content is green tea (*Camellia sinensis* L.). Green tea contains polyphenols consisting of flavonoid compounds, which function as antioxidants (Astuti et al., 2017). Virgin Coconut Oil (VCO) has many benefits in the pharmaceutical and health sectors. VCO also has a very high antioxidant and moisturizing content (Badaring et al., 2020). The antioxidant content in virgin coconut oil is tocopherol, which can prevent tissue damage, protect the skin, and prevent the development of spots on the skin due to aging (Chacko, 2017). VCO can even repair damaged or diseased skin. Therefore, the use of VCO will be able to reveal younger skin (Purnamasari, 2020). Based on the above, research was carried out on making green tea leaf extract antioxidant gel with VCO to find a good formula for green tea leaf extract antioxidant gel with VCO.

2 Materials and Method

2.1 Materials

Green tea leaf extract, virgin coconut oil, HPMC, propylene glycol, methyl paraben, propyl paraben, distilled water, methanol, DPPH, Quercetin.

2.2 Method

Green Tea Leaf Extracting

The extraction method used to make green tea leaf extract is the infusion method. The mashed simplicia is mixed with sufficient water in a pan (K. Sayuti & Yenrina., 2015). Then heat in a water bath for 15 minutes, counting from when the temperature in the pan reaches 90°C, while stirring occasionally. The infusion results are filtered while hot with flannel cloth (Redjeki, 2015).

Virgin Coconut Oil Production

The method used to make virgin coconut oil is an enzymatic process. Let the coconut milk that has been obtained sit for 8 hours. After letting it sit, two parts will form: the top part is cream, and the bottom is water (N. A. Sayuti, 2015). Then, put the cream in a container, add pineapple root extract, and stir until evenly mixed. After that, let it sit for 24 hours until three layers are formed; the first is "*blondo*", the second is oil, and the third is water. The oil obtained is filtered using filter paper (Utami et al., 2021).

Green Tea Leaf Extract Antioxidant Gel Formulation with Virgin Coconut Oil

Antioxidant gel formulation for green tea leaf extract with VCO using the formula in Table 1.

Table 1. Formulation of Antioxidant Gel Tea Leaf with VCO

Materials concentration (gram)	Formula				
	A	B	C	D	E
Green tea leaf extract	10	-	10	10	10
Virgin coconut oil (VCO)	-	3	3	6	9
HPMC	2	2	2	2	2
Propylene glycol	5	5	5	5	5
Metil paraben	0,18	0,18	0,18	0,18	0,18
Propyl paraben	0,02	0,02	0,02	0,02	0,02
Aquadest (g) ad	100	100	100	100	100

Formulating antioxidant gel from green tea leaf extract with VCO was first carried out by developing HPMC by adding distilled water at a temperature of 90°C, then stirring until clear and homogenous (Wardiyah, 2022). Methyl paraben, propyl paraben dissolved in propylene glycol; then the solution is mixed with developed HPMC and stirred until homogeneous. The green tea leaf extract is added to the base, then stirred until homogeneous. Then add VCO to the solution and stir until homogeneous. Lastly, add the remaining distilled water and stir until homogeneous.

Physical Evaluation of Green Leaf Extract Antioxidant Gel Preparation with VCO

Organoleptic Test

Visually observed the antioxidant gel preparation of green tea leaf extract with VCO, including the preparation's color, odor, and texture(Izzati, N.N., Diniatik., 2012).

Homogeneity Test

Apply an antioxidant gel of green tea leaf extract with virgin coconut oil, which will be tested on a glass object (Lumentut et al., 2020). Then observe. If there are no coarse grains on the three glass objects, the gel tested is homogeneous.

Spread ability Test

Weighed 0.5 grams of gel, placed it on a glass covered with graph paper, put a petri dish on top of the gel mass, and left for 1 minute. The diameter of the gel that spreads (by taking the average length of the diameter from several sides) is measured, then 50 g, 100 g, 150 g, and 200 g are added as an additional load (Sukamdi & Kurniawan, M. F., Damarwati, 2021). Each additional load is left for 1 minute, and then the diameter of the gel that spreads is recorded as before. (Purwanto & Zamzani, 2020).

Adhesion Test

Place enough gel on top of another glass object on top of the gel, then press it with a 500 g load for 5 minutes place the glass object on the test tool, then release the 20 g load and note the time until the two things are separated (Purwanto & Zamzani, 2020).

pH Test

The pH test is carried out using a pH meter. Then the electrode is dipped into the preparation. The pH value that appears on the screen is recorded. Measurements were carried out at room temperature (Sutarna et al., 2013). Ideally, topical preparations have a pH value that is the same as the skin's pH, namely 5-7 so that irritation does not occur on the skin surface (Anindhita & Oktaviani, 2020).

Viscosity Test

The viscosity test was carried out using a Brookfield viscometer. Measurements were carried out with spindle number 64 at a speed of 10 rpm (Pujiastuti & Kristiani, 2019). Viscosity is known by observing the movement of the viscosity needle, which points to a certain number (A. E. P. Putri & Agustyiani, 2017).

Antioxidant Activity Test

Antioxidant activity was tested by taking the test solution and quercetin solution, 2 ml of each level, 2 ml of DPPH solution, adding 6 ml of methanol, and homogenizing (Tanasale, 2013). Next, leave it for 30 minutes in a closed room. The absorbance of the sample is read at the maximum DPPH wavelength (Maulana K et al., 2019).

3 Results and Discussion

3.1 Organoleptic Test

Organoleptic tests were carried out using direct visual observation to determine the physical properties of the antioxidant gel from green tea leaf extract with VCO. From the observations, the odor in formulas C, D, and E has the characteristic aroma of virgin coconut oil. Meanwhile, the scent in Formula A has the distinctive aroma of green tea leaves. Meanwhile, the smell of Formula B has the distinct aroma of virgin coconut oil.

The colors of the five formulas are different, with Formula A having a clear brown color, formula B having a clear white color, formula C, D, and E having a dark brown color (Rukmana et al., 2015). Observation results of the texture of the gel preparations of the five formulations showed that they all had a thick consistency.

3.2 Homogeneity Test

The homogeneity test aims to determine the homogeneity of the gel by looking at the uniformity of the particles in the preparation. The five formulas are homogeneous because all parts are mixed well, and there are no coarse particles. Thus, all gel formulation has good homogeneity (Hasanah et al., 2017).

3.3 Spread ability Test

The spread ability test aims to determine the quality of the gel that spreads on the skin. The spread ability of the gel is good, namely 5-7 cm (W. E. Putri & Anindhita,

2022). The data obtained based on the results of the dispersion test can be seen in Table 2.

Table 2. Spread ability Test Result	
Formula	Result
A	5,7
B	5,6
C	5,8
D	5,5
E	5,3

The results from Table 2 show that all formulas meet the requirements for good gel spreadability. Based on the analysis using One-Way Anova, it produces a p-value <0.05, which means that increasing the concentration of VCO can affect the spread ability.

3.4 Adhesion Test

The gel adhesion test determines the bond between the antioxidant gel from green tea leaf extract and virgin coconut oil and the skin. Good adhesive strength of the preparation is at least 4 seconds (Muazham, 2018). The gel's adhesion is good namely, it can coat the skin well and not cover the pores. Data was obtained based on the adhesion test results in Table 3.

Table 3. Adhesion Test Result	
Formula	Result (minutes)
A	1,51
B	1,61
C	1,58
D	1,66
E	1,73

The results of the adhesion evaluation obtained were that it met the requirements. Data shows that the resulting antioxidant gel of green tea leaf extract with virgin coconut oil can adhere well to the skin. The higher the concentration of VCO, the longer the gel will stick due to increased viscosity. Based on the analysis using One-Way Anova results, it produces a p-value <0.05, which means that increasing the concentration of virgin coconut oil can affect adhesion.

3.5 PH Test

The pH test aims to determine whether the antioxidant gel from green tea leaf extract with virgin coconut oil is safe to use on the skin. The pH test results must be adjusted to the skin's pH, 4.5-7, to avoid skin irritation (Anindhita & Oktaviani, 2020). Based on the results of analysis using One-Way Anova, it produces a p-value <0.05, which

means that increasing the concentration of virgin coconut oil can affect pH. Data was obtained for each formula based on pH measurements, as seen in Table 4.

Table 4. PH Test Result

Formula	Result
A	5,530
B	5,571
C	5,071
D	5,324
E	5,555

3.6 Viscosity Test

The viscosity test aims to determine the durability of the antioxidant gel preparation of green tea leaf extract with virgin coconut oil. Reasonable gel preparation viscosity test requirements are 6000-50000 cP (Hidayanti et al., 2015). Based on test results (Table 5), if the viscosity value is higher, the viscosity of a gel will increase.

Table 5. Viscosity Test Result

Formula	Result (cP)
A	6840
B	17480
C	8640
D	14220
E	17480

Based on existing requirements, the five formulas created have suitable viscosity. Based on the results of analysis using One-Way Anova, it produces a p-value <0.05, which means that increasing the concentration of virgin coconut oil can affect its viscosity.

3.7 Antioxidant Test

In Table 6, it is stated that formulas A, B, C, D, E, and quercetin respectively obtained an average IC₅₀ value of 84,509 ppm, 121,213 ppm, 75,804 ppm, 63,405 ppm, 47,316 ppm, and 8,130 ppm (Tehubijuluw et al., 2018). Based on the results of analysis using One-Way Anova, it produces a p-value <0.05, which means that increasing the concentration of virgin coconut oil can affect its antioxidant activity.

Table 6. Antioxidant Test Result

Formula	Average Ic50 (ppm)	Antioxidant Activity Category
A	84,509	Strong
B	121,213	Medium
C	75,804	Strong
D	63,405	Strong

Formula	Average Ic50 (ppm)	Antioxidant Activity Category
E	47,316	Very Strong
Quercetin	8,130	Very Strong

4 Conclusion

- Adding the concentration of virgin coconut oil affects the pH value, stickiness, spreadability, and viscosity.
- The concentration of VCO in the gel affects the IC50 value. The higher the concentration of VCO, the higher the antioxidant activity.

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