Sofia Fatmawati-Sunscreen Factor Formulation and Test of Gel Preparations of 70% Ethanol Extract on Arabica Coffee Leaf (Coffea arabica L.)

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Sunscreen Factor Formulation and Test of Gel Preparations of 70% Ethanol Extract on Arabica Coffee Leaf (*Coffea arabica* L.)

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Abstract. Arabica coffee leaf extract (*Coffea arabica* L.) contains phenolic and flavonoid compounds that are potentially active as sunscreen because it might absorb UV (Ultra Violet) A and UV B rays. It is well-known that UV rays exposure causes a negative effect to skin, yet is possible to be avoided by applying sunscreen. This research aims to test the effect of arabica coffee leaf extract on formulation of gel preparations and to discover how its concentration affects the amount of gel preparations' sunscreen factor. There were 4 formulas with different extract concentrations whose characteristics were tested chemically, physically, and they were tested to measure its SPF number. From this test, it was discovered that the gel was qualified and it was plastic thixotropic flow. The measurement of SPF number proposed that F1 could not be categorized as protector because it was only 0.6 while F2, F3, and F4 showed that these formulas could be categorized as minimum protector. The samples were also tested statistically by using One Way ANOVA and Tukey HSD test. The result of the ANOVA test showed the number of sig 0.000 < 0.05 which meant all four formulas were significantly different. The research concludes that the extract of arabica coffee leaf might affect the formulation of gel preparations and its extract concentration might affect SPF number on gel preparations.

1. Introduction

Skin does an important role to protect the body from outside environments such as physical impact and exposure to free radicals. In order to maximize the function of the skin as a protector, it is necessary to give special treatment on the skin. Amongst information about how dangerous UV rays affect our skin, it is also well-known that sunscreen has been trusted to protect our skin from the damage of UV rays[1].

UV rays are rays that are emitted by the sun that can reach the earth surface beside visible light and infrared rays. The wavelength of UV rays is approximately 200-400 nm. The UV spectrum, based on the wavelength, is categorized into three; UV C (200-290), UV B (290-320) and UV A (320-400). Not all of these three UV rays' radiation can reach earth's surface. UV C rays, the one with the strongest energy, cannot reach the surface because of being absorbed in ozone [2].

It is known that UV radiation from the sun causes some damages to human skin. UV A radiation is discovered to cause damages to skin cells and DNA. It also causes photoaging and photocarcinogenesis. These damages can be caused by long term exposure of the sun's rays, even in a small dose. UV A radiation contributes to the decreasing of skin elasticity, the increasing of wrinkles, and the increasing of free radicals that cause acute to chronic changes to skin. Besides, UV A radiation

also makes other diseases worsen, such as lupus erythematosus. It also contributes as immunosuppressants that increase cancer cell growth [3]. From another resource, it is stated that the exposure of ultraviolet radiation might cause epidermis damages, which is also called sunburn, pigmentation, wrinkling, premature skin aging, and long term exposure of the sun's rays can also cause mutation of lugature tissue in the stratum corneum[4]

On the other hand, the sun's rays stimulate melanin and pigment as natural sunscreen for human skin. The sun's rays also stimulate hormone protection which allows vitamin D synthesizing to increase skin cell regeneration. It is discovered that the shorter the wavelength, the stronger the energy level, which also causes more damage to the skin (Lu et al., 1996). If the sun's rays expose the skin excessively, it might not resist the negative effects. Therefore, it is necessary to give some protection by using sunscreen. Sunscreen is preparations applied on skin to absorb, to scatter, or to reflect UV rays. It is also applied to help natural protection mechanisms to protect skin from dangerous UV radiation of the sun's rays [6]. It is a product that provides protection from the damage of the sun's rays, but this product is commonly made of synthetic chemicals which allow, in long term exposure, some bad effects to human skin. This research is conducted, to test the formula, so that there would be a chance for natural ingredients to be natural protection which causes less bad effect [7]. The grade of sunscreen's photo-protective is universally measured by Sun Protective Factor (SPF) which determines the increase of the sun's rays' exposure dose with photo-protective products applied without eritema [8].

Coffee is categorized into genus Coffea in the family of Rubiaceae. Genus Coffea L. consists of more than 100 species, but only two species, *Coffea arabica* (arabica coffee) and *Coffea canephora* (robusta coffee), are commercially cultivated on large scales [9]. *Coffea arabica* is a tetraploid species from highland rain forest in the south of Ethiopia. Six of eight chosen species are closely related, including two commercial species *Coffea arabica* dan *Coffea canephora*, as illustrated in the recent phylogeny from genus [10].

Coffee leaf has not been optimally utilized. In Indonesia, coffee leaf is used as a brewed drink named "Aia Kawa" in Sumatera [11]. It is discovered that *Coffea arabica* leaf contains phenolic compounds with a concentration of 17.4% in green leaf and 13.9% in old/pure leaf (Rodrigues et al., 2008). Arabica coffee leaf contains some compounds, such as alkaloid, flavonoid, and phenol which are included into the derivative of hydroxycinnamic acid, caffeine, chlorogenic acid, coumarin, ferulic acid and cinnamic acid. Chlorogenic acid is easily oxidized in aqueous solutions [13] [14].

Phenolic and flavonoid compounds have potential as sunscreen [15]. Flavonoid is commonly able to absorb UV rays, but not able to absorb any radiation on wavelength around 280-315 nm maximally, as other phenylpropanoid compounds. However, compared with other phenylpropanoid compounds, flavonoid compounds will increase significantly, as it is exposed by UV B rays' radiation, including the derivative of hydroxycinnamic acid (for instance: p-Coumaric acid, ferulic acid and caffeine acid). Some research showed that when UV B rays' exposes plants, flavonoid concentration is increased compared with hydroxycinnamic compounds [16].

Sunscreen is applied to help natural protection mechanisms to protect skin from dangerous UV radiation of the sun's rays [6]. It is a product that provides protection from the damage of the sun's rays, but this product is commonly made of synthetic chemicals. In the market, sunscreen is provided in some forms of preparations; salve, cream, gel, lotion, spray, and wax stick [17]. Gel is a semi-solid preparation which consists of suspensions made of inorganic particles in small parts or organic molecules in big parts penetrated by some kinds of fluid [18].

In Indonesia, research related to arabica coffee leaves is limited. Therefore, it is necessary to conduct further research because the resources are overflowing and it should be utilized and developed, for instance, for cosmetic purposes. This research aims to fill the void in the literatures related to arabica coffee leaf by testing how the extract of arabica coffee leaf affects the formulation of gel preparations and discovering how far the extract of arabica coffee leaf concentration affects the grade of Sun Protective Factor of gel preparations.

2. Material and Methods

2.1 Material

The materials used in this study were arabica coffee leaves (Coffea arabica L.) as the active ingredient which was obtained by maceration using 70% ethanol. The chemicals used for the gel formulation were HPMC K100M type 2208 (High Viscosity Grade), Propylene Glycol (Pharmaceutical Grade), Methyl Paraben (Pharmaceutical Grade), Propyl Paraben (Pharmaceutical Grade), Aqua Dest, 70% Ethanol and 70% Ethanol for analysis.

2.2 Plant Determination

The determination of the arabica coffee plant used in the research was carried out at the Herbarium Bogoriense, Botany Division, Biological Research Center, LIPI Cibinong.

2.3 Arabica Coffee Leaf Extraction

Coarse powder of arabica coffee leaves that have been obtained from IPB Bogor was re-pollinated using a grinder or blender. It was then sieved using a mesh sieve no. 40. The extraction method used maceration. The maceration extraction method (cold method) is a better method for extracting cherry leaves compared to the soxhlation method (hot method). This is due to the thermolable nature of flavonoids which will be damaged when extracted using a soxhletation [19]. 1:10 fine powder and macerated solvent. A total of 1300 grams of powder was macerated with 9700 ml of 70% ethanol filter in a dark glass jar at room temperature. It was then left for 2 days and stirred every 8 hours. The maceration results were filtered with a flannel cloth and filter paper. Then, the remaining dregs were re-macerated with 3300 ml of sprinkler for 1 day. Afterwards, it was stirred and filtered again. The filtrate obtained was then concentrated using a rotary vacuum evaporator at a temperature of 50 ° C until a thick extract was obtained. Thick extract of arabica coffee leaves, and the yield was obtained. The yield was calculated based on the ratio of the final weight (weight of the extract produced) to the initial weight (weight of cell biomass used) multiplied by 100% [20].

2.4 Organoleptic Determination of Arabica Coffee Leaf Extract and Determination of Ash Content

Organoleptic determination of arabica coffee leaf extract was carried out by observing the shape, color, and odor of the arabica coffee leaf extract. 2 g of extract was weighed carefully and put in a porcelain crucible that had been annealed,tared, and leveled. Krus was slowly annealed until the charcoal ran out. Afterglow was carried out at a temperature of 600ºC for 3 hours, which was then cooled and weighed until a fixed weight was obtained. The ash content was calculated against the material which was dried in the air. If in this way the charcoal cannot be removed, hot water can be added and filtered with an ash-free filter paper. The rest of the paper and filter paper was glazed in the same crucible. The filtrate was put into the crucible, and left to evaporate. Afterglow until the weight was fixed, weighed and calculated.

2.5 Phytochemical Screening Test

Extract was identified of alkaloid, flavonoid, phenol, saponin, tannin, steroid, and triterpenoid contents using Harbonne or Material Medica Method.

2.6 Gel Formulation

Arabica coffee leaf extract gel formula (*Coffea arabica* L.) consisted of arabica coffee leaf extract (*Coffea arabica* L.), HPMC K100M type 2208, Propylene Glycol, Methyl Paraben, Propyl Paraben and Aqua Dest. The gel formulation can be seen in table (1).

Table 1. Formulation Gel Arabica Coffee Leaf Extract

No.	Materials	% (b/v)				Functions
		F1	F2	F3	F4	
1	Ekstract	-	1.5	2	2.5	Active ingredients
2	HPMC	1	1	1	1	*Gelling agent*
3	Propylene Glycol	15	15	15	15	Humectant
4	MethylParaben	0.075	0.075	0.075	0.075	Preservatives
5	Propylparaben	0.025	0.025	0.025	0.025	Preservatives
6	Aqua Dest ad	100	100	100	100	solvent

2.7 Procedure for Preparation Arabica Coffee Leaf Extract Gel

HPMC 4.5 g was developed in a mortar with aqua dest and was then expanded for 24 hours and crushed to form a gel mass (M1). 0.3775 g of methyl paraben was dissolved with a portion of propylene glycol (M2). 0.1125 g of propyl paraben was dissolved with a portion of propylene glycol (M3). The arabica coffee leaf extract was also dissolved with the remaining propylene glycol (M4). M1, M2 and M3, M4 were mixed, crushed, and homogeneous. Furthermore, the evaluation of the determination of the FPS value of gel preparations were carried out.

2.8 Organoleptic Test for Gel

Organoleptic testing was carried out by direct observation of the shape, color and smell of the gel made. Gel was usually clear with a semi-solid consistency[18].

2.9 Homogeneity Test

The homogeneity test was carried out by applying 0.1 g of gel preparation to a piece of transparent glass and observing its homogeneity. The test preparation must show a homogeneous arrangement, indicated by the absence of coarse grains on the object glass [21].

2.10 pH test

The pH test was carried out by turning on the pH meter then dipping the pH meter electrode into the gel formula. It was left for a few moments until the pH meter screen showed a stable number [22].

2.11 Spreadability Test

As much as 1 gram of gel preparat was placed carefully on a glass measuring 20x20 cm, and was given a 125 gram weight on it.It was then measured the diameter formed after 1 minute [23].

2.12 Adhesion Test

A total of 1 gram of gel preparation was flattened on one glass o ct and covered with another glass object until the two plates were joined. The object glass pair was pressed with a load of 1000 g for 5 minutes. It was then installed on the adhesion test equipment, while simultaneously recording the time it took for the two plates to come off each other [24].

2.13 Viscosity and Flow Properties Test

The viscosity test was performed using the Brookfield Viscometer RV type. The gel preparation as put into a 500 mL beaker glass container, then 'the spindle n 04 was installed. Afterwards, the spindle was lowered into the preparation to the specified limit. The tool was turned on and set at a speed

of 10 rpm, 12 rpm, 20 rpm, 30 rpm and 50 rpm to show a stable number. Then, the results were recorded. To determine the flow properties of the preparation, a curve was made between the shear rate and shear stress [21].

2.14 Centrifugation Test

10 grams of each preparation were put into a centrifugation tube and centrifuged at 3750 rpm for 5 hours. It was then observed whether there was separation or not in the gel [21].

2.15 Freeze Thaw Test

The phase separation cycle using the freeze thaw method on the gel preparation was carried out in 6 cycles for each formula. Each cycle was observed after 48 hours of storage at 4°C and 48 hours after at 45°C for 24 days. Each cycle was observed whether there was phase separation or not on the gel preparation [21].

2.16 Determination of the FPS Value of Arabica Coffee Leaf Extract

The FPS value of the extract in vitro was determined using the Uv-Vis spectrophotometric method developed by Mansur (1986) using equation 3. The extract was diluted with a concentration of 60 ppm, 80 ppm and 100 ppm with 70% pa ethanol and then measured using the Uv-Vis spectrophotometer at a wavelength of 290-320 nm. The determination of the FPS value was carried out in three replications. Then, the data obtained was processed with the Mansur equation (1986). To determine the FPS value of this wavelength, the EE x I value has been described in table 2 [7].

2.17 Determination of the FPS Value of Arabica Coffee Leaf Extract Gel Preparation

The FPS value of the extract in vitro was determined using the Uv-Vis spectrophotometric method developed by Mansur (1986) using equation 3. The preparation was weighed as much as 0.02 grams in 5 mL ethanol 70% pa and then measured using a Uv-Vis spectrophotometer at a wavelength 290-320 nm. The determination of the FPS value was carried out in three replications. Then, the data obtained was processed with the Mansur equation (1986). To determine the FPS value of this wavelength, the EE x I value has been described in table 2 [7].

The equation for determining the FPS value can be seen in below:

$$SPF = CF \; x \; \sum_{290}^{320} \; x \; EE(\lambda) \; x \; I(\lambda) \; x \; Abs(\lambda)$$

Based on this equation, there was a variable CF (Correction Factor) = 10, EE (Erythemogenic Effect), I is the simulated intensity of sunlight and Abs is the absorbance of the sample.

The value of EE x I can be seen in table 2.

Table 2 The Value of EE x I

Wave Length (nm)	EE x I
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180

According to the FDA (Food Drug Administration), the distribution of sunscreen capabilities is Minimum (SPF is between 2-4), Medium (SPF is between 4-6), Extra (SPF is between 6-8), Maximum (SPF is between 8-15), and Ultra (SPF is more than 15) [25].

2.18 Statistical Analysis

Qualitative testing of physical characteristics and determination of the FPS value of gel preparations were analyzed using One Way ANOVA, with a confidence level of 95% (p> 0.05). If there WEre significant differences between formulas, we then proceeded with the Tukey HSD test to see which formulas had significant differences.

3. Results and Discussion

The object of this research was fresh arabica coffee plants (*Coffea arabica* L.). Then, the fresh arabica coffee plants were determined in Herbarium Bogoriense, Botany Department Biology Research Center, LIPI Cibinong. The determination of the plants in this research meant to find out the clear identity of the research object to avoid mistakes in collecting main material for the research. After determined, it was confirmed that the plants were arabica coffee leaf (*Coffea arabica* L.).

Table 3. The Results of Characterization pf Arabica Coffee Leaf Extract

Examination	Results
yield	9.84%
Organoleptic:	
a. form	Thick extract
b. smell	coffee
c. taste	bitter
d. color	Chocolate black
Drying shrinkage	6.61% ± 0.43
Ash content	9.26% ± 0.46

Based on the results of phytochemical screening tests, 70% thick ethanol extract of arabica coffee leaves had alkaloid, phenolic, flavonoid, saponin, tannin and steroid compounds. This is in accordance with previous research [26], [27]. By knowing the truth of its benefits, arabica coffee leaf extract can be formulated into gel preparations that contain antioxidants.

Table 4. Results of Phytochemical Screening Test

Compound	Result
Phenolic	+
Alkaloids	+
Flavonoids	+
Saponins	+
Tannins	+
Steroids	+
Triterpenoid	-

Organoleptic tests included observations on the consistency, color and odor of the gel preparation. The results of organoleptic testing can be seen in table 5. In accordance with the results from the organoleptic test, it was found that all four formulas had semi-solid consistency. For F1, the gel was clear/transparent and odorless because it was not mixed with the extract, while for F2, F3, and F4, they were clear brown and had a typical smell from the extract. The extract concentration affected the color of gel preparations, the higher the concentration, the deeper the brown color.

Homogeneity test aimed to determine the homogeneity of preparations that have been made, homogeneous preparations will produce good quality because it showed the active ingredients of the drug are evenly dispersed in the basic ingredients. Based on the research results, the four formulas produced a homogeneous gel.

Table 5. Results of Organoleptic Tests and Homogeneity Tests

Formula	Organoleptic			
	Consistency	Color	Smell	Homogeneity
1	Semisolid	Transparent	Odorless	Homogeneous
2	Semisolid	Clear brown	Unique	Homogeneous
3	Semisolid	Clear brown	Unique	Homogeneous
4	Semisolid	Clear brown	Unique	Homogeneous

The purpose of this test was to determine that the resulting gel was acceptable for skin pH, because if it is not in accordance with the pH of the skin it can cause irritation. Based on the results of the study, the four formulas met the pH criteria on sunscreen preparations. pH test discovered that all formulas were qualified for pH criterias on sunscreen preparations, which was around 4.5-8.0 (SNI, 1996). The extract concentration affected the acid of the preparations because the extract contained a flavonoid compound which was quite acidic. Therefore, the more the arabica coffee leaf extract concentration, the more the acid it has (Markham, 1988). Arabica coffee leaf extract was 6.16 [37] A product that had too high or too low pH could cause irritation on skin [6]. The graph of the pH test results can be seen in Figure 1.

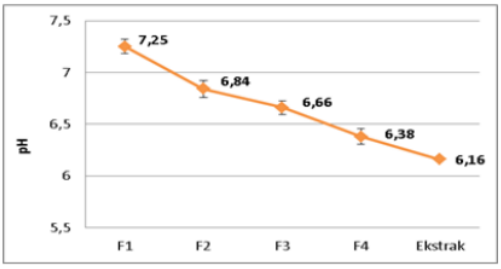

Figure 1. The Results of pH test

The dispersion test was carried out to ensure that the semisolid preparations are able to spread easily without significant pressure so that they are easy to apply without causing pain and provide comfort to the user. The graph of the results of the scattering power test can be seen in Figure 2. The greater the spreadability of the preparation, the greater the ability of the active substance to spread and contact with the skin. The spreadability is inversely proportional to viscosity, the greater the viscosity of a preparation, the thicker the consistency, so that the resulting spreadability is smaller [30].

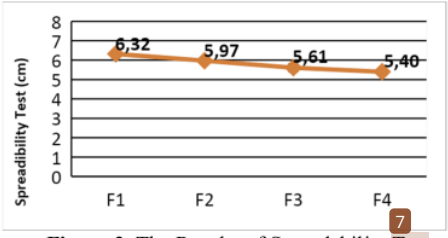

Figure 2. The Results of Spreadability Test

The adhesion test was carried out to determine the ability of the gel to adhere to the skin surface. The graph of the adhesion test results can be seen in Figure 3. Based on the research results, the four formulas met the adhesion criteria. Topical preparations must have sufficient adhesiveness but should not be sticky to the skin as they can reduce comfort during use.

The viscosity test was aimed to determine the thickness of the gel preparation. The higher the viscosity value, the higher the viscosity level of the gel preparation. Viscosity was tested by using *Brookfield* Viscometer RV type. The result revealed that all formulas were qualified for criterias of gel viscosity, which was 2000-4000 *cPs.* [31]. Gel consistency, which was not too liquid or too thick, was a characteristic of the good gel. HPMC concentration in gel preparations was used only 1%, as HPMC K100M is categorized into *High Viscosity Grade* which can be read in *Certificate of Analysis*. Gel viscosity affects the gel itself to disperse and adhere to skin. The higher the viscosity, the more difficult the gel to disperse although it is easier to adhere on skin. The higher the viscosity, the smaller the separation rate of dispersed phase [32]. Of the four formulas, the gel viscosity criteria were met. The graph of the results of the viscosity test can be seen in Figure 4.

All four formulas produced plastic thixotropic flow. It could be seen that the curve was started without getting through point zero (0) but cutting the axis of motion stress (or the outside of the curve was extrapolated cutting the axis) at the certain points named yield grade [33]. It was also shown that the decreased curve was to the left of the increased curve because there was structural change that did not immediately return to the first condition, if the pressure was diminished. Yield grade resulted from F1 was f = 3.496 dyne/cm², F2 was f = 3.097 dyne/cm², F3 was f = 2.979 dyne/cm² and F4 was f = 3.557 dyne/cm². Thixotropic is the characteristic of the flow that is expected for semi-solid preparations because it is expected to be in high consistency in a container. Nevertheless, it is easier to pour when it is given force, making it easier to be applied on skin [34]

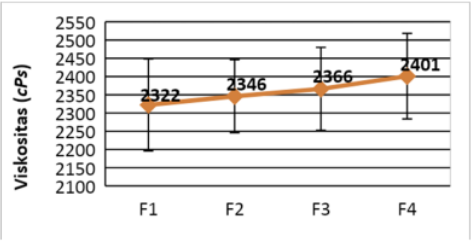

Figure 3. The Results of Viscosity Test

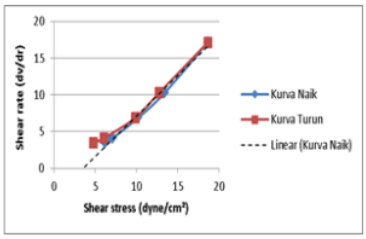

Figure 4. Flow Properties Formula 1

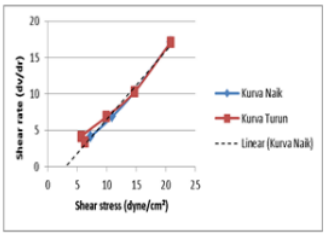

Figure 5. Flow Properties Formula 2

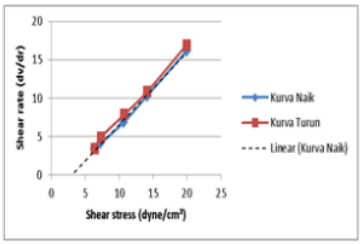

Figure 6. Flow Properties Formula 3

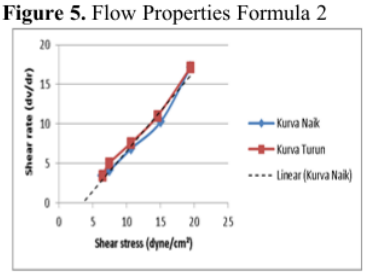

Figure 7. Flow Properties Formula 4

The centrifugation test aimed to observe whether there is a phase separation of the gel preparation and to see the stability of the gel preparation after very strong shaking. Based on the research results, the four formulas did not undergo phase separation or syneresis. The table of centrifugation test results can be seen in table 6.

Table 6. Centrifugation Test

Formula		Results
F1	1	-
	2	-
	3	-
F2	1	-
	2	-
	3	-
F3	1	-
	2	-
	3	-
F4	1	-
	2	-
	3	-

Note : (-) no separation phase

The freeze thaw test is a test that has the purpose of simulating the product during the distribution process in vehicles, which are rarely equipped with temperature control devices. Therefore, this test was carried out at a certain temperature or humidity at a certain time so that the product in its packaging will undergo various changes. If during the six cycles, the preparation is stable or there is no phase that changes, it means that the product is stable during the distribution process [35]. Based on the results of the freeze thaw test, the four formulas were stable as there was no phase separation. The table of freeze thaw test results can be seen in table 7.

Table 7. Results of *Freeze Thaw*

cycle		F1			F2			F3			F4		
		1	2	3	1	2	3	1	2	3	1	2	3
1	4°C	-	-	-	-	-	-	-	-	-	-	-	-
	45°C	-	-	-	-	-	-	-	-	-	-	-	-
2	4°C	-	-	-	-	-	-	-	-	-	-	-	-
	45°C	-	-	-	-	-	-	-	-	-	-	-	-
3	4°C	-	-	-	-	-	-	-	-	-	-	-	-
	45°C	-	-	-	-	-	-	-	-	-	-	-	-
4	4°C	-	-	-	-	-	-	-	-	-	-	-	-
	45°C	-	-	-	-	-	-	-	-	-	-	-	-
5	4°C	-	-	-	-	-	-	-	-	-	-	-	-
	45°C	-	-	-	-	-	-	-	-	-	-	-	-
6	4°C	-	-	-	-	-	-	-	-	-	-	-	-
	45°C	-	-	-	-	-	-	-	-	-	-	-	-

Note: (-) no separation phase

The Sun Protection Factor (SPF) value or FPS value is measured as the ability or effectiveness of a material as a sunscreen. The higher the FPS value, the better the sunscreen will protect against UV rays. The purpose of using sunscreen is based on its ability to absorb, reflect or scatter sunlight [36]. The value of FPS was determined in vitro using the UV-vis spectrophotometry method developed by Mansur (1986). It was done by measuring the absorbance of each sample, namely the extract of arabica coffee leaves and the four formulas for the gel preparation for three replications with a wavelength between 290 - 320 nm where the measurements were described for each 5 nm interval. It is known that the arabica coffee leaf extract has these groups found in flavonoids and phenolic compounds, making it able to absorb radiation energy and produce absorbance values on the uv-vis spectrophotometer.

Based on the results of the study, the arabica coffee leaf extract has a concentration of 60 ppm. Of the three extract concentrations, it has a minimal protection category. The F1 gel preparation was a negative control, which did not contain extracts but produced a low FPS value for sunscreen so that it did not fall into the protection category. F2, F3 and F4 have a minimal protection category. The results of determining the FPS value of extracts and gel preparations can be seen in table 8 and table 9. From the second to fourth formulas, all formulas had minimal protection categories. From the results, it was obtained that gel preparations produce low protection on the skin. This can be overcome by adding other active sunscreen ingredients to support the effectiveness of sunscreens to produce more maximally.

On the SPF grade of the gel preparation that was higher than the extract, from the results of the research of [38] Donglikar and Deore (2017), it was revealed that the phytochemical SPF of the formulation was higher, which indicated the synergy and compatibility of the excipients as well. This result indicated that the prepared formulation has good SPF and good sun protection activity. Moreo et al., (2013) explained that this is possible to happen because it is influenced by the combination and concentration of the gel carrier component, the type of gel, the effect of the interaction of the carrier component such as the humectant used in the formulation. This factor can increase or decrease the UV absorption of sunscreens [39].

Therefore, to develop sunscreens with better safety and high SPF, the formulator must understand the physicochemical principles of not only active UV absorbance, but also vehicle components, such as esters, emulsifiers and emulsifiers used in formulationsThis is because sunscreens can interact with other components of the vehicle, and this interaction can affect the efficacy of the sunscreen.

Table 8. Results of SPF Value Extract

Sample	FPS Va;ue	Protection Category
Ekstract 60 ppm	2.08	Minimum protection
Ekstract 80 ppm	2.49	Minimum protection
Ekstract 100 ppm	3.68	Minimum protection

Table 9. Results of SPF Value Gel Extract

Sample	Value SPF	Protection Category
Formula 1	0.61	-
Formula 2	2.59	Minimum protection
Formula 3	2.95	Minimum protection
Formula 4	3.64	Minimum protection

4. Conclusions

Based on the research results, arabica coffee leaf extract could affect the gel dosage formulation and meet the specified requirements. The results of the ANOVA test showed a grade significance of 0.000 < 0.05, where there were significant differences in the formulas for gel preparations. This showed that the concentration of arabica coffee leaf extract could affect the SPF value of the gel preparation. In this study, a gel preparation formulation that met the pharmaceutical requirements was obtained by providing an SPF grade with minimal protection.

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