

FORMULATION AND EVALUATION OF PEEL OFF GEL FACIAL MASK FROM ARABICA COFFEE FRUIT PEEL EXTRACT (*COFFEA ARABICA* L.)

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ABSTRACT

Objective: The aim of this study was to obtain a peel off gel facial mask preparation from Arabica coffee fruit peel extract that meets the requirements and to determine the antioxidant activity of Arabica coffee fruit peel extract and peel off gel facial mask preparation from coffee fruit peel extract

Methods: In this study, three formulations of peel off gel facial mask were made with 3 variations in the concentration of coffee fruit peel extract, namely F1 (1%), F2 (2%), and F3 (3%). Furthermore, the preparation was evaluated for 28 d of storage at room temperature (25-30 °C) and cold temperature (8 °C) which included organoleptic, pH, spreading ability, homogeneity, viscosity, dry time, and antioxidant activity.

Results: The results of the evaluation showed that F1, F2, and F3 met the requirements which included organoleptic, pH, spreading ability, homogeneity, viscosity, and dry time. The antioxidant activity of the coffee fruit peel extract was very strong (IC₅₀ 17.36 µg/ml). The antioxidant activity in the peel off gel facial mask sample of formula F1 (IC₅₀ 75.63 µg/ml) and formula F2 (IC₅₀ 50.71 µg/ml) was strong, and for formula F3 was very strong (IC₅₀ 21.44 µg/ml).

Conclusion: All formulas met the evaluation requirements, arabica coffee fruit peel extract and peel of gel facial mask preparation (F3) have very strong antioxidant activity.

Keywords: Arabica coffee fruit peel extract (*Coffea arabica* L.), Peel off gel facial mask, Antioxidant, DPPH

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INTRODUCTION

The skin is the body's defense system that protects internal organs from sun exposure. Human skin will be damaged if exposed to excessive sunlight. UV rays are one of the external factors that cause premature aging [1]. Excessive exposure to UV rays will trigger the formation of free radicals which can be characterized by symptoms of the skin damage process such as the appearance of wrinkles, dryness, scales, and cracks. In addition to looking dull and wrinkled, the skin ages faster and black spots appear [2]. Efforts to counteract the effects caused by free radicals are needed for antioxidants. Antioxidants are compounds that can neutralize and reduce free radicals and inhibit oxidation in cells, thereby reducing cell damage, such as premature aging [3]. The process of preventing premature aging can be done by using cosmetics made from natural ingredients that function as antioxidants. Natural ingredients that are efficacious in cosmetics are more often used because they are considered to be able to overcome skin problems. Natural ingredients are better than synthetic materials, because synthetic materials can cause side effects [4]. However, not a few wastes of natural materials are thrown away because they are considered not to provide health benefits. In fact, some of the waste of natural ingredients can provide benefits for health, especially the skin. One of the waste natural ingredients that can be used as an active ingredient in cosmetics is the skin waste of Arabica coffee (*Coffea arabica* L.). Arabica coffee fruit peel waste is waste from processing Arabica coffee cherries which has not been utilized optimally. Arabica coffee fruit peel waste contains polyphenols which are secondary metabolites that function as antioxidants [5]. Facial cosmetics can be available in various forms, one of which is in the form of masks. Of the several types of mask products circulating in the community, the most practical mask products to use are peel off gel masks or masks that after drying can be peeled off immediately [6].

Based on the background of the problem that has been described, the researchers are interested in conducting research by developing a peel off gel facial mask preparation of Arabica coffee fruit peel extract (*Coffea arabica* L.) which is varied in the concentration of the extract.

MATERIALS AND METHODS

Materials

Arabica coffee fruit peel (*Coffea arabica* L.) obtained from Kp. Cibodas, Desa Lebak Muncang Ciwidey. The coffee fruit peel has been identified with the number 42/HB/10/2019 at the Herbarium Jatinangor, Laboratory of Plant Taxonomy Department Biology, Universitas Padjadjaran West Java, Indonesia. Arabica coffee fruit peel extract was obtained from MarkHerb School of Pharmacy Institut Teknologi Bandung Indonesia with the number 19-11/S-MH/I. Additional materials used were PVA, HPMC, Glycerin, TEA, Methyl Paraben, Propyl Paraben, Methanol pro-analysis (p. a) 96%, DPPH and distilled water.

Identification of polyphenols in arabica coffee fruit skin extract

Evaluation of polyphenols in the fruit peel extract of Arabica coffee (*Coffea arabica* L.) can be carried out by reacting a solution of the fruit peel extract of Arabica coffee (*Coffea arabica* L.) with a solution of iron (III) chloride 10%, if blue black or green black color occurs, it indicates the presence of polyphenol compounds [7].

Preparation peel off gel facial mask

In this study, 3 formulas (F1, F2, and F3) were made for peel off gel mask of Arabica coffee fruit peel extract (*Coffea arabica* L.) with varying concentrations of Arabica coffee fruit peel extract, respectively, by 1%, 2%, and 3%. The composition of the peel off gel facial mask was shown in table 1.

All ingredients were prepared and weighed. PVA was developed with distilled water at 80 °C and HPMC was developed with distilled water. PVA was added to HPMC and stirred. Methyl paraben and propyl paraben which have been dissolved with hot distilled water into the mixture. Then all the ingredients are stirred and mixed with glycerin, TEA, and coffee rind extract in a beaker glass under stirring. Furthermore, distilled water was added until 100% w/w total volume [7, 8].

Table 1: Formula peel off gel facial mask of Arabica coffee fruit peel extract

Ingredients	Formula (% w/v)		
	F1	F2	F3
Arabica coffee fruit peel extract	1	2	3
PVA	14	14	14
HPMC	2	2	2
Glycerin	12	12	12
TEA	2	2	2
Methyl Paraben	0.1	0.1	0.1
Propyl Paraben	0.1	0.1	0.1
Distilled water added until	100	100	100

Evaluation peel off gel facial mask

Physical evaluation was carried out during 28 d of storage, namely days 0, 1, 7, 14, 21, and 28 [9], at room temperature (25-30 °C) and cold temperature (8 °C) [10]. Organoleptic test aim to observe the changes in shape, odor or not, and discoloration [11]. The pH test of the gel preparation was carried out using universal pH. The spreading ability test was carried out by taking a sample of 1 gram and then placing it on a watch glass, where the upper watch glass was loaded with a 125 gram weight with a time span of 1-2 min, then the diameter of the spread was measured [12]. The homogeneity test was carried out by placing the preparation between two slides and observing their appearance and presence of any aggregates [13]. Viscosity test was performed using a Brookfield LV Viscometer [12]. Evaluation of dry time Test time done by applying a gel mask *peel off* in the skin of the arm with a length of 7 cm and a width of 7 cm, then calculated the speed of gel to form a continuous film of gel mask *peel off* by using a *stopwatch* [14].

Antioxidant activity test

The antioxidant activity of coffee fruit peel extract and peel off gel facial mask were tested using DPPH scavenging activity method [13]. A total of 1 mg of DPPH was put into a 50 ml volumetric flask and dissolved with methanol p. a to a concentration of 20 ppm [2]. The extract solution was prepared by dissolving 10 mg of the extract in 100 ml of methanol p. a, then varying the concentration, namely 5 ppm, 10 ppm, 15 ppm, 20 ppm, and 25 ppm [15]. As for the sample of gel peel off mask is done by taken as 1 g dosage is then extracted by the addition of 100 ml of methanol p. a so that the sample solution that is made has a concentration of 10,000 ppm. Next, shake it quickly for ±5 min. Then the results of shaking are filtered and the filtrate is collected. Sample dilution was carried out to a concentration of 5 ppm; 10 ppm, 15 ppm, 20 ppm, and 25 ppm. Samples were incubated at 37 °C for 30 min and then the absorbance was measured using a UV-Vis spectrophotometer at a wavelength of 517 nm [16]. Free radical scavenging activity was calculated as the percentage of DPPH color reduction using the inhibition measurement equation. Then % inhibitions were plotted against the respective concentration used and from the graph IC₅₀ was calculated [17].

Statistical analysis

The statistical analysis was using the one-way analysis of variance (ANOVA) method. If the data were not normally distributed, then the Kruskal-Wallis analysis method was used to investigate variations to extract concentration effect on the evaluation of the peel off gel facial mask [8].

RESULTS

Identification of polyphenols in extract is already done by adding a solution of FeCl₃. The results of observations formed a blue-black or greenish black color which indicated that there was polyphenol content in the Arabica coffee fruit peel extract [18].

The results of the organoleptic evaluation of the three peel off gel mask formulations were semi-solid form, and only had a distinctive coffee aroma. The color of the preparation F1 has a yellow-brown color, while F2 and F3 have a dark brown color because the concentration of F1 extract is lower than F2 and F3. During 28 d of storage at room temperature and cold temperature, the three formulas did not change in form, color and odor (table 2). The results of the evaluation of the pH of the three formulations of the peel off gel facial mask extract of Arabica coffee fruit peel were pH 5. During 28 d of storage, the pH test results for the peel off gel mask both at room temperature and cold temperatures met the requirement (table 3). The results of the spreading ability evaluation from three formulas were 5.7 cm (table 3). During 28 d of storage, the dispersion of the peel off gel facial mask preparation of Arabica coffee fruit peel extract F1, F2, and F3 at room and cold temperature changed but still met the requirements for a spreading ability range of 5-7 cm (table 3) [19]. The evaluation results indicate that the homogeneity of the three formulas is homogenous. During the 28 d of storage at room and cold temperature three formulas remain homogeneous. The results of the viscosity evaluation showed that the three formulas met the requirements and had a viscosity of 13000 cps (table 4). During 28 d of storage, there was a change in the viscosity of the peel off gel facial mask preparations F1, F2, and F3 both at room temperature and cold temperatures. Changes that occur still meet the viscosity requirements for gel preparations, namely in the range 7100-83144 cps [20]. The results of the evaluation of the dry time for 13 min (table 4). During 28 d of storage, the peel off gel facial mask preparations F1, F2, and F3 both at room temperature and cold temperature did not change in the dry time test results [12].

Table 2: Organoleptic of peel off gel facial mask at room temperature and cold room

Formula	Organoleptic	Time (Day)					
		0	1	7	14	21	28
F1	Form	SS	SS	SS	SS	SS	SS
	Color	YB	YB	YB	YB	YB	YB
	Odor	CA	CA	CA	CA	CA	CA
F2	Form	SS	SS	SS	SS	SS	SS
	Color	DB	DB	DB	DB	DB	DB
	Odor	CA	CA	CA	CA	CA	CA
F3	Form	SS	SS	SS	SS	SS	SS
	Color	DB	DB	DB	DB	DB	DB
	Odor	CA	CA	CA	CA	CA	CA

Description: SS (Semi Solid), YB (Yellow Brown), DB (Dark Brown), CA (Coffee Aroma)

Table 3: pH and spreading ability of peel off gel facial mask

Time (Day)	pH			Spreading ability (cm)								
	Room temperature			Cold temperature			Room temperature			Cold temperature		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
0	5	5	5	5	5	5	5.7	5.7	5.7	5.7	5.7	5.7
1	5	5	5	5	5	5	5.5	5	5.5	5	5	5
7	5	5	5	5	5	5	5.3	5.2	5.2	5	5	5
14	6	6	6	6	6	6	5.7	5.5	5.8	5	5	5
21	6	6	6	6	6	6	5.2	5.5	5.7	5	5	5
28	6	6	6	6	6	6	5.2	5.7	5.7	5	5	5

Table 4: Viscosity and dry time of peel off gel facial mask

Time (Day)	Viscosity (cps)			Dry time (minute)								
	Room temperature			Cold temperature			Room temperature			Cold temperature		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
0	13.000	13.000	13.000	13.000	13.000	13.000	13	13	13	13	13	13
1	13.500	13.250	13.000	17.500	14.500	18.000	13	13	13	13	13	13
7	13.500	13.500	13.500	17.750	15.000	21.500	13	13	13	13	13	13
14	18.000	14.500	17.000	20.500	14.000	24.000	13	13	13	13	13	13
21	15.000	13.500	18.000	17.500	15.000	35.750	13	13	13	13	13	13
28	18.000	21.500	17.500	32.500	32.500	35.750	13	13	13	13	13	13

Arabica coffee fruit peel extract has IC_{50} 17.36 $\mu\text{g/ml}$. Peel off gel facial mask sample has IC_{50} value of F1 75.63 $\mu\text{g/ml}$, F2 50.71 $\mu\text{g/ml}$, and F3 21.44 $\mu\text{g/ml}$. The antioxidant activity (IC_{50} value) of arabica coffee fruit peel extract and peel off gel facial mask formula was shown in table 5.

Table 5: The antioxidant activity of arabica coffee fruit peel extract and peel off gel facial mask

Sample	IC_{50} $\mu\text{g/ml}$
Arabica coffee fruit peel extract	17.36
F1	75.63
F2	50.71
F3	21.44

The normality test showed that distributed data is not normal ($p < 0.05$), then continued with the Kruskal-Wallis test. Statistical analysis using Kruskal Wallis Method to investigate the effect of extract concentration on the evaluation results of peel off gel facial mask. Variations in the concentration of coffee fruit peel extract in the peel off gel facial mask had a significant effect ($p < 0.05$) on organoleptic, and had no significant effect ($p > 0.05$) on pH, spreading ability, homogeneity, viscosity, and dry time [8].

DISCUSSION

The peel off gel mask formulation contains HPMC as a gelling agent and PVA which functions as a gelling agent, where the addition of these ingredients will produce a gel base that can form an elastic film layer so that the formed film can be removed easily without cracking and tearing. The addition of glycerin works as a humectant in maintaining skin moisture. As a pH stabilizer and alkaline atmosphere, TEA is added. The preservatives used in the peel-off gel mask formula are methyl paraben and propyl paraben. A combination of preservatives is used to enhance the effect against bacteria and fungi [21]. Arabica coffee rind extract in the formula works as an antioxidant.

Based on the results of organoleptic observations of the three formulations, the higher the concentration of the extract, the more concentrated the color of the preparation. During 28 d of storage, the pH test results for peel-off gel masks both at room temperature and cold temperatures increased. The increase in pH was due to the presence of TEA in the formula. Based on research conducted by Mutiana and Iyan (2018) that the preparation of turmeric rhizome extract cream experienced an increase in pH during the 6-week shelf life due to the presence of TEA in the formula [22]. The results of the spreading ability evaluation from three formulas are 5.7 cm. During storage, there may be a change in dispersion due to the retention of the solvent absorbed by the gelling agent. This is because HPMC forms a gel by absorbing the solvent and retains the liquid by forming a compact liquid mass [8].

The peel off gel mask preparation has good homogeneity, indicated by all the particles observed on the object glass being evenly dispersed and no clumping occurs. This decrease is due to the increased viscosity so that the spreading ability decreases [19]. In

accordance with previous research conducted by Phindo (2016) peel off gel mask preparations that have good homogeneity are characterized by the absence of coarse particles in the preparation [23]. The viscosity of the peel off gel mask preparation changes when stored at room temperature or cold temperatures. This change is because the gel preparation has properties where if left undisturbed such as stirring, the viscosity will increase and then decrease, this property is thixotropy [24]. The peel off gel mask preparation has a dry time of 13 min. The ideal characteristic of a peel-off gel face mask is that it is able to provide a moisturizing effect on the skin, forms a uniform thin film, gives a firming effect to the skin and can dry within 5-30 min [8].

The antioxidant activity test was carried out using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method [2]. DPPH is a free radical compound that will react with antioxidant compounds through the mechanism of H atom donation and cause a change in color from purple to pale yellow as measured using a UV-vis spectrophotometer at a wavelength of 517 nm. IC_{50} was used as a parameter indicating antioxidant activity. IC_{50} is a number that indicates the concentration of a compound capable of inhibiting 50% of free radicals. The smaller the IC_{50} value obtained, the higher the antioxidant activity. According to Molyneux (2004) it is known that a compound is said to be a very strong antioxidant if the IC_{50} is less than a value of less than 50 ppm ($IC_{50} < 50$ ppm), strong (50 ppm $< IC_{50} < 100$ ppm), moderate (100 ppm $< IC_{50} < 150$ ppm), weak (150 ppm $< IC_{50} < 200$ ppm), and very weak ($IC_{50} > 200$ ppm) [25]. Thus, it can be seen that the antioxidant activity of the coffee fruit peel extract was very strong (IC_{50} 17.36 $\mu\text{g/ml}$). The antioxidant activity in the peel off gel facial mask sample of F1 (IC_{50} 75.63 $\mu\text{g/ml}$) and F2 (IC_{50} 50.71 $\mu\text{g/ml}$) was strong, and for F3 was very strong (IC_{50} 21.44 $\mu\text{g/ml}$) [25].

CONCLUSION

All formulas met the evaluation requirements, arabica coffee fruit peel extract and peel of gel facial mask preparation (F3) have very strong antioxidant activity.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

The authors have no conflict of interest to declare.

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