ANTIOXIDANT ACTIVITY OF PEEL-OFF GEL MASK OF ALOE VERA AND STRAWBERRY

JAMILATUN, M.[1*] – LUKITO, P. I.[1] – RAYHANISSA, R. A. D.[1]

[1] *Department of Pharmaceutical and Food Analysis, Health Polytechnic of Health Ministry Surakarta, Klaten, Indonesia.*

**Corresponding author*
e-mail: makhabbah.j[at]gmail.com

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Abstract. Free radicals can cause oxidative damage to skin cells, causing aging. One way to overcome this is by adding antioxidants which can be obtained from natural ingredients such as aloe vera and strawberries. This study aims to determine the physical quality and antioxidant activity of aloe vera and strawberry peel-off gel masks. The research method is experimental. The research includes making aloe vera and strawberry peel-off gel masks with varying concentrations of F0 (0:0), F1 (25:75), F2 (50:50), and F3 (75:25). Physical quality tests include organoleptic, pH, homogeneity, spreadability, stickiness, and drying time as well as antioxidant activity tests. The research results showed that the organoleptic was in the form of a thick liquid in all formulas, a transparent white color with no smell in F0, a dark brown color with a typical extract smell in F1, a brown color with a typical extract smell in F2, a light brown color with a typical extract smell in F3. The homogeneity test results for all formulas are homogeneous. The pH value is slightly above the requirements. The spreadability, stickiness, and drying time of the peel-off gel mask meet the requirements. Antioxidant activity obtained IC50 values of 212.36 µg/mL (F0); 139.53 µg/ (F1); 71.45 (F2); and 116.31 µg/mL (F3). The best formula obtained was F2 because it met the physical quality requirements and had the strongest antioxidant activity. In conclusion, aloe vera and strawberries can be used as active sources of antioxidants in cosmetics.
Keywords: *peel off gel mask, aloe vera, strawberry, antioxidant*

Introduction

Free radicals can cause oxidative damage to skin cells, causing aging (Zięba and Marwicka, 2020). Aging of the skin is characterized by the appearance of wrinkles, cracking, dullness, dryness, skin aging quickly, and the appearance of dark spots. One way to overcome this is to add antioxidants to the skin (Knaggs and Lephart, 2023; Chng et al., 2021), so that it can ward off free radicals from sunlight. For the skin, the effect of antioxidants is better if formulated in topical preparations (Azevedo Martins et al., 2020), such as cosmetics used for care, so that active substances can interact with the skin longer. Antioxidants can be obtained from plants (Azevedo Martins et al., 2020), such as aloe vera and strawberries. Aloe vera and strawberries are beneficial for health and beauty. Aloe vera contains flavonoid compounds (Tizazu and Bekele, 2024; Andiva et al., 2023). This compound can be an antioxidant because it is a good acceptor against free radicals (Taherkhani et al., 2021). Aloe vera also contains amino acids, minerals, vitamins, polysaccharides, and other components. Red strawberries indicate that this fruit is rich in anthocyanin pigments which act as antioxidants (Martínez-Ferri et al., 2023). The vitamin C content of strawberries is also an antioxidant that is beneficial for the skin (Samee et al., 2023). In addition, strawberries also have other substances including salicylic acid, vitamin A, vitamin B1, vitamin B2, tocopherol acetate (vitamin E), ellagic acid, and vitamin K which can smooth the skin, brighten the skin and prevent skin wrinkles (Hong et al., 2025).

Aloe vera and strawberries have often been used in cosmetics. One type of cosmetic for treatment is a peel-off gel mask. A mask in the form of a gel and applied to the skin for a certain time until it dries. This preparation forms a transparent, elastic film layer so that it can be peeled off (Jamilatun et al., 2024b). The advantages of using this peel-off mask are that it is practical to apply and does not have a dependency effect on the product. In addition, peel-off facial masks help increase skin hydration, repair and treat facial skin from wrinkles, aging, and acne, and can be used to shrink pores, cleanse and moisturize the skin, and are useful in relaxing facial muscles, becoming a cleanser, freshener, moisturizer and softener for facial skin (Riwanti and Prasetyanti, 2024). Based on this background, a study was conducted on the formulation of aloe vera and strawberry extracts in a peel-off gel mask. This study aims to determine the physical quality and antioxidant activity of aloe vera and strawberry peel-off gel masks.

Materials and Methods

The materials used include aloe vera, strawberries, DPPH powder (1,1-diphenyl-2-picylhydrazyl), 96% ethanol, methanol p.a, PVA (polyvinyl alcohol), HPMC (Hydroxy Propyl Methyl Cellulose), glycerin, TEA (Triethanolamine), propylparaben, methylparaben, and distilled water. The tools used include porcelain cups, dropper pipettes, micropipettes, analytical balances (Labex), test tubes (iwaki), beakers (iwaki), measuring cups (iwaki), glass funnels, watch glasses, pots/containers, flannel cloth, mortars, blenders, stirring rods, spatulas, glass jars, filter paper, pH meters, hotplates, aluminum foil, water baths and UV-Vis Spectrophotometers (Raptor). Research procedures include sampling and extract preparation, aloe vera and strawberry peel-off gel mask formulation, making peel-off gel mask, physical quality test and antioxidant activity test of aloe vera and strawberry peel-off gel mask. Aloe vera was taken from an aloe vera cultivation site in Ketep, Magelang, Central Java, Indonesia. Strawberries were taken from a strawberry plantation in Tawangmangu, Central Java, Indonesia. Aloe vera was extracted by maceration, namely 4 kg of aloe vera was peeled to obtain 1000 g of aloe vera gel. Furthermore, the gel was smoothed with a blender and soaked in 1000 ml of 96% ethanol solvent. It was left for 3 days in a closed vessel (glass jar). Then filtered with a cloth filter and collected in a bottle. The extract obtained was then evaporated with a rotary evaporator or water bath at a temperature of 60℃ to obtain a thick extract. Fresh strawberries were weighed 100 grams and then macerated with 96% ethanol using a tightly closed dark container for 3 days, maceration was repeated until a clear solution was obtained. The macerate obtained was concentrated using a water bath at a temperature of 60℃ to produce a thick extract.

Making peel-off gel mask of aloe vera and strawberry

The ingredients for making the peel-off gel mask are prepared according to the formula in *Table 1*. The peel-off gel mask is made according to the reference, in the following way. PVA is put into a cup, then enough distilled water is added, then heated over a water bath at a temperature of 80 ℃ until it expands perfectly, and mass 1 is obtained. Glycerin, methylparaben, and propylparaben are dissolved in hot distilled water in another cup so that mass 2 is obtained. Then HPMC in another cup is added with cold distilled water until it expands perfectly. Furthermore, Mass 1, Mass 2, HPMC, and TEA are successively put into a clean mortar and stirred until homogeneous. After that, the remaining distilled water is added little by little and then

stirred until homogeneous. Some of the gel mask base is put into a clean and dry mortar and then ground until homogeneous. After that, aloe vera and strawberry extracts are put into the mortar and ground, then the gel base is added, and ground until homogeneous. Next, the formula is put into a container and then labeled according to the ratio of the peel-off gel mask.

***Table 1**. Aloe vera and strawberry peel-off gel mask formula.*

Material	F0	F1	F2	F3
Aloe vera extract (g)	-	1,75	2,5	3,25
Strawberry extract (g)	-	3,25	2,5	1,75
PVA (g)	10	10	10	10
HPMC (g)	2	2	2	2
Glycerin (g)	12	12	12	12
TEA (g)	2	2	2	2
Propyl paraben (g)	0,05	0,05	0,05	0,05
Methyl paraben (g)	0,2	0,2	0,2	0,2
Aquadest add (mL)	100	100	100	100

Note: F0=peel-off gel mask base that does not contain active ingredients; F1=peel off gel mask with added aloe vera and strawberry in a ratio of 25:75; F2=peel off gel mask with added aloe vera and strawberry in a ratio of 50:50; F3=peel off gel mask with added aloe vera and strawberry in a ratio of 75:25.

Physical quality test of aloe vera and strawberry peel-off gel mask

(1) Organoleptic tests were carried out using the five senses, to observe the color, odor, and shape of the aloe vera and strawberry extract peel-off gel mask (Jamilatun et al., 2025a; 2024a). (2) The pH test was carried out by taking 1 g of the peel-off gel mask diluting it using distilled water, and stirring until homogeneous then the pH meter was inserted and the value appeared. (3) The homogeneity test was carried out by applying the sample to a piece of glass or other suitable transparent material, the preparation must show a homogeneous composition and no coarse grains were visible. (4) The spreadability test was carried out by placing 0.5 g of the peel-off gel mask on a glass plate and leaving it for 1 minute, then the spread diameter was measured. Next, a load of 150 g is added and left for 1 minute, then the constant diameter is measured (Jamilatun et al., 2024c). (5) The adhesive power test is carried out by placing 0.5 grams of gel on a glass object then covering it with another glass object, and giving a load of 1 kg for 3 minutes. Determination of adhesive power is the time required for both glass objects to be released (Jamilatun et al., 2025b). (6) The drying time test is carried out by weighing 1 gram of the preparation, applying it to the skin, and leaving it to dry (Amanah et al., 2021).

Antioxidant activity test of aloe vera and strawberry peel-off gel mask

Antioxidant activity test refers to previous research (Jamilatun et al., 2025a). (1) Preparation of 40 ppm DPPH Solution, by weighing 4 mg DPPH then dissolving it in 100 mL of methanol p.a. (2) Determination of Maximum Wavelength, by taking 40 ppm DPPH Solution, pipetting as much as 2 ml and adding 2 ml of methanol p.a., shaken until homogeneous. The solution is put into a cuvette with a blank methanol p.a., and measured at a wavelength of 500-530 nm using UV-Vis spectrophotometry. (3) Preparation of 1000 ppm Sample Master Solution, by weighing each formula as much

as 10 mg, then adding methanol p.a. in a 10 ml measuring flask to the limit mark. (4) Preparation of sample series solutions. A series of concentrations of the parent sample solution of 10, 20, 30, 40, and 50 ppm were made. The concentration series can be made by pipetting 0.5 ml, 1 ml, 1.5 ml, 2 ml, and 2.5 ml of the parent sample solution into a 5 ml measuring flask and then adding methanol p.a to the limit mark. (5) Determination of antioxidant activity in peel-off masks. Sample solutions from 5 concentration series were pipetted as much as 2 ml into a test tube then 2 ml of DPPH reagent was added. Then homogenized and incubated in a dark room for 30 minutes. Analysis was carried out by measuring the absorbance with a UV-Vis spectrophotometer at the maximum wavelength. (6) The sample absorbance data were used to calculate the % inhibition, which was used to find the IC50 value using linear regression (y = a + bx). This equation is used to determine the IC50 value of each formula.

Results and Discussion

This study was conducted to determine the physical quality and antioxidant activity of aloe vera and strawberry peel-off gel masks, as well as to determine the best formula based on physical quality and antioxidant activity. The physical quality of the preparations observed included organoleptic, pH, homogeneity, spreadability, adhesion, and drying time. Extraction of aloe vera and strawberry was carried out using the maceration method. Maceration is a process of extracting simple drugs using solvents and occasional stirring, carried out at room temperature (Marlina et al., 2022). Maceration aims to extract active substances that are heat-resistant and heat-resistant. Extraction is carried out using ethanol solvent because ethanol is polar so it can bind phenolic compounds (Hakim and Saputri, 2020). Ethanol is also able to extract more chemical compounds than water. The results of maceration of aloe vera and strawberry obtained thick extracts with yields of 1.21% and 7.72% respectively. The ingredients formulated in the peel-off gel mask include PVA, HPMC, glycerin, TEA, propyl paraben, methylparaben, and distilled water. PVA is a synthetic polymer that is soluble in water and functions as a filming agent, HPMC is used as a gelling agent (emulsifier and thickener) that dissolves in hot water. Glycerin as a humectant, TEA functions as an alkalizing agent (pH stabilizer), propyl paraben and methyl paraben function as preservatives and antifungals, distilled water acts as a solvent (Syam et al., 2021; Densi and Mila, 2019; Hanan and Puji, 2018).

Aloe vera and strawberry peel-off gel mask is formulated using a modified formulation from research (Simanungsong, 2019), made with 4 variations of formula, F0 is a gel base where there are no active ingredients, F1 is a peel-off gel mask with the addition of aloe vera and strawberries in a ratio of 25:75. F2 is a peel-off gel mask with the addition of aloe vera and strawberries in a ratio of 50:50. F3 is a peel-off gel mask with the addition of aloe vera and strawberries in a ratio of 75:25. The physical quality of the aloe vera and strawberry peel-off gel mask can be seen in *Table 2*. The organoleptic of F0 is transparent white because there is no additional extract, has a distinctive odor of extract, and is in the form of a thick liquid. In F1 it is dark brown, has a distinctive odor of extract, and is in the form of a thick liquid. The dark brown color produced in F1 is due to the addition of high strawberry extract. In F2 it has a brown color, a distinctive odor of extract, and is in the form of a thick liquid. The resulting brown color is obtained from a mixture of aloe vera and strawberry extracts with an equal ratio. In F3 it has a light brown color, a distinctive odor of extract, and is

in the form of a thick liquid. The resulting color is obtained from a mixture of aloe vera and strawberry extracts with a higher ratio of aloe vera extract. The greater the concentration of extract used can produce a color difference (Jamilatun et al., 2025b). The pH value of the aloe vera and strawberry peel-off gel mask ranges from 7.4 to 7.5. The pH value that can be accepted by the skin ranges from 5 to 7. Topical preparations must meet these requirements, because if the pH is too alkaline, the skin will become scaly, conversely if the skin pH is too acidic, it can trigger skin irritation (Thomas et al., 2023). From the tests that have been carried out, the aloe vera and strawberry peel-off gel mask slightly exceeds the pH value range for topical preparations. Homogeneity testing of the aloe vera and strawberry peel-off gel mask is indicated by the absence of coarse and separated particles in the preparation (Jamilatun et al., 2024b). Based on *Table 2*. the results of the homogeneity test on the peel-off gel mask, each homogeneous formula.

***Table 2**. Quality of aloe vera and strawberry peel-off gel mask.*

Formulas	Organoleptic (Color, Smell, Texture)	pH	Homogeneity	Spread Power (cm)	Adhesion (seconds)	Drying Time (minutes)	IC_{50} Value (µg/mL)/ Antioxidant Properties
F0	White transparent, odorless, liquid	8,1	Homogen	6,2	10,7	28	212,36 (weak)
F1	Dark Brown, distinctive, liquid	7,4	Homogen	7,1	15,8	28	139,53 (medium)
F2	Brown, distinctive, thick liquid	7,5	Homogen	6,7	5,6	28	71,45 (strong)
F3	Light Brown, distinctive, liquid	7,4	Homogen	6,7	5,2	28	116,31 (medium)

Note: F0=peel-off gel mask base that does not contain active ingredients; F1=peel off gel mask with added aloe vera and strawberry in a ratio of 25:75; F2=peel off gel mask with added aloe vera and strawberry in a ratio of 50:50; F3=peel off gel mask with added aloe vera and strawberry in a ratio of 75:25.

Spreadability testing aims to determine the ability of the mask to spread when applied to the skin. The easier the preparation is to use, the more optimal the absorption of active substances on the skin will be (Yuhara et al., 2023), a good mask spreadability ranges from 5-7 cm. Based on *Table 2*. the spreadability of the aloe vera and strawberry peel-off gel mask has met the standards in the literature. The examination of adhesion is related to the ability of the gel to coat the surface of the skin so as not to clog pores and not inhibit the physiological function of the skin (Ghiffari et al., 2024). Good adhesion to semi-solid preparations is more than 1 second (Jamilatun et al., 2025a). Based on *Table 2*. the adhesion of the aloe vera and strawberry peel-off gel mask has met the requirements with a range of 5.2 seconds - 10.7 seconds. The drying time test aims to determine how long it takes for the peel-off gel mask to dry on the skin's surface and form a film layer. Based on *Table 2*, the aloe vera and strawberry peel-off gel masks meet the requirements for good drying time, namely between 15 and 30 minutes (Setiyanto and Amalia, 2024). The antioxidant activity of aloe vera and strawberry peel-off gel masks is shown in *Table 2*. The results show that the lowest IC50 value is in F0 with a value of 212.36 µg/mL because it is a gel base without the addition of extract. Meanwhile, the high IC50 is in F2 with a value of 71.45 µg/mL, with a balanced amount of extract used. Aloe vera contains flavonoids (Tizazu and Bekele, 2024), while strawberries contain vitamin C compounds (Kishimoto et al., 2023), each of which can function as an antioxidant. Based on the results of this study, it can be seen that aloe

vera and strawberries can be used as active ingredients and sources of antioxidants in cosmetics. Antioxidants are useful for preventing the effects of free radicals in the form of premature aging and skin cancer (Amin Hussen et al., 2025).

Conclusion

The physical quality of the aloe vera and strawberry peel-off gel mask showed organoleptic results with a thick liquid form in all formulas, a transparent white color with no odor in F0, a dark brown color with a typical extract odor in F1, a brown color with a typical extract odor in F2, a light brown color with a typical extract odor in F3. The pH was 8.1 (F0); 7.4 (F1); 7.5 (F2); 7.4 (F3). The results of the homogeneity test on all formulas were homogeneous. Spreadability (cm) was 6.2 (F0); 7.1 (F1); 6.7 (F2); and 6.7 (F3). Adhesiveness (seconds) was 10.7 (F0); 15.8 (F1); 5.6 (F2); and 5.2 (F3) respectively. The drying time (minutes) of each formula was 28. The antioxidant activity obtained IC_{50} values of 212.36 µg/mL (weak) in F0; 139.53 µg/mL (moderate) in F1; 71.45 µg/mL (strong) in F2; and 116.31 µg/mL (moderate) in F3. The best formula for aloe vera and strawberry peel-off gel mask is F2, which meets the quality requirements and has the strongest antioxidant activity of 71.45 µg/mL.

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Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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