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The Potency Peel-off Mask Gel from Corn Leaf (*Zea mays* L) as Natural Antioxidant

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Abstract: ***Plant antioxidants come from phenol-derivative compounds such as flavonoids, hydroxamic acid derivatives, coumarins, tocopherols, and organic acids. Corn (Zea mays L) is a plant known for its antioxidant properties. The utilization of corn by-products, particularly pharmaceutical derived from corn leaf, has not been widely explored. Therefore, this research aims to formulatea corn leaf peel-off mask gel at concentrations of 0.5%, 1%, 1.5%, and 3%. The assessment of the corn leaf peel-off mask gel quality involves physical evaluations, characteristic tests, as well as antioxidant activity. The results indicates that Corn Leaf Extract can be formulated into a peel-off mask gel, meets the dosage quality tests, includingorganoleptic, homogeneity, pH, and spreadability. Antioxidant test results show that the 3% corn leaf peel-off mask gelexhibits strong antioxidant value of 2.57411 ppm.***

Keywords: Corn Leaf, Peel-Off Mask Gel, Antioxidant

1. Introduction

Daily human activities are consistently exposed to free radicals, such as air pollution emitted from vehicles, burning rubbish, cigarette smoke, sunlight exposure, drugs, etc. Free radicals can oxidize DNA, nucleic acids, unsaturated fatty acids, carbohydrates, fats, and proteins leading to degenerative diseases [2]. The human body undergoes a continuous oxidation process that produces active oxygen and free radicals. Scientific evidence suggests that the risk of chronic disease caused by free radicals can be reduced by utilizing antioxidants [3]. These antioxidants can be classified into two groups: natural antioxidants and synthetic antioxidants[3]. Natural antioxidants in plants come from phenol derivative groups such as flavonoids, hydroxyamic acid compound derivatives, coumarins, tocopherols, and organic acids.

One plant known for its antioxidant properties is corn.Corn is widely consumed due to its sweeter taste, fragrant aroma, and contains sucrose sugar, and lowfat content, making it suitable for diabetes patients [4]. Yellow Manado corn contains phenolic and carotenoid that exhibit antioxidant activity [5,6]. Yellow corn is considered of high quality compared with white corn attributed to its yellow color which is believed to be a source of vitamins [7]. While several studies have been conducted, however, there is a need to develop corn into a cosmetic. Facial care cosmetics such as peel-off masks, are easy to apply due to their gel form, drying quickly, and easily removable or like an elastic membrane [8]. Formulating a peel-off mask gel from corn leaf, however, has not been explored yet. Therefore, utilizing corn leaf extract as a peel-off mask gel can help minimize leaf waste currently discarded.

2. Material and method

2.1 Material

Corn leaf was obtained from local farm in Ratahan, Minahasa Tenggara regency, Ethanol 96%, Polivinylalcohol (PVA), Hidroxy Propyl Methylcelulosa (HPMC), Glycerin, Triethanolamin (TEA), Nipagin, Nipasol, aquadest, ethanolp.a, CTM p.a, and DPPH

2.2 Method

Preparation of corn leaf
Corn leaf are washed with running water to remove adhering dirt, then chopped into small pieces and dried in an oven at 40 ^{o}C. The dried samples were ground using a blender. The corn leaf sample powder was sieved to obtain a fine powder.

Extraction
Three hundred grams of the sample were weighed and extracted using maceration with 1500 mL of 96% ethanol as a solvent for 3 cyles of 24 hours each. The mixture was then filtered using filter paper to obtain filtrate 1 and residue. The residue was re-macerated with 900 mL of ethanol for 2 days, and resulted in filtrate (2) and residue. Both filtrate 1 and Filtrate 2 were concentrated using a rotary evaporator.

Formulation of *peel-off* mask gel from corn leaf

Table 1: Peel-off mask gel formulation

Material	Concentration				
	F0	F1	F2	F3	F4
Corn leaf extract	0	0,5g	1 g	1,5g	3g
Polyvinylalcohol (PVA)	10g	10g	10g	10g	10g
Hidroxy Propyl Methylcelulose (HPMC)	1g	1g	1g	1g	1g
Glycerin	12mL	12mL	12 mL	12 mL	12 mL
Triethanolamin (TEA)	2mL	2 mL	2 mL	2 mL	2 mL
Nipagine	0.2g	0.2g	0.2g	0.2g	0.2g
Nipasol	0.05g	0.05g	0.05g	0.05g	0.05g
Aquadest	ad100	ad100	ad100	ad100	ad100

Note
F0: Basis mask of *peel-off* gel without corn leaf extract (blank)
F1:mask of *peel-off* gel from corn leaf0,5%
F2: mask of *peel-off* gel from corn leaf 1 %
F3: mask of *peel-off* gel from corn leaf 1,5 %
F4:mask of *peel-off* gel from corn leaf 3%

Procedure for making peel-off mask gel

PVA was added to 20 mL of hot distilled water at a temperature of 85°C, then stirred using a magnetic stirrer at a speed ranging 420-1300 rpm to form a homogeneous gel mass (mass 1). In another container, HPMC was dispersed in cold distilled water until it expanded perfectly. Glycerin, Nipagin and Nipasol were dissolved in hot distilled water (mass 2). In a mortar, mass 1, mass 2, HPMC, and TEA were added successively and stirred until homogeneous. The resulting preparation was stored in a plastic pot.

2.3 Evaluation of the quality gel preparation

a) Organoleptic test
The corn leaf peel-off mask gel that has been made is then subjected to observation, which includes assessing the color, smell, and clarity [9].

b) Homogeneity test
Homogeneity testing involved smearing a sample of the corn leaf peel-off mask gel mass on the glass object, and observing for homogeneity [10].

c) pH test
Dissolve 1 g of corn leaf peel-off mask gelin 10 mL of distilled water (10%), and observe the pH based on the color change on pH paper [11].

d) Drying time test
Smeared with a total of 0.5 g of corn leaf peel-off mask gel on a glass object approximately 1 mm thick, it was then placed in the oven at 37 ^{o}C, and the drying time was measured using a stopwatch [11].

e) Spreadability test
One gram of corn leaf peel-off mask gel was placed on a glass surface, covered with another glass, and subjected to a weight of 150 g. After 1 minutes, the form diameter was measured [11].

2.4 Antioxidant Test

a) Preparation ofDPPH radicals reagent
A total of 2.5 mg of DPPH radical was dissolved in ethanol, then placed into a 25 mL measuring flask and diluted to the mark.

b) Preparation of main solution for corn leaf peel-off mask gel
Weigh the corn leaf extract according to the specified concentration then dissolve it in ethanol p.a., then transfer it in a 100 mL measuring flask, diluting it to the mark.

c) Preparation of main solution for corn leaf peel-off mask gel
Weigh 1 g of sample, dissolve it in ethanol p.a., then transfer it to a 100 mL measuring flask, diluting it to the mark.

d) Determination of antioxidant activity
The 1,1-diphenyl-2-picrylhydrazyl (DPPH) is a dark purple compound. The DPPH free radical scavenger method measures synthetic free radical scavengers in polar solvents (such as ethanol or methanol) at room temperature. This method evaluates the antioxidant capacity of components through changes in absorbance at 515 to 517 nm. The absorbance decreases when the odd electron of the nitrogen atom in DPPH is reduced by accepting a hydrogen atom from the antioxidant (AH). Compounds that rapidly reduce DPPH absorbance by providing hydrogen atoms are considered good antioxidants[12].

3. Result and Discussion

A total of 4.5 kg of corn leaves yields 420.0652 g of simplicia. The extraction process is conducted using the maceration method. 400 g of corn leaf simplicia is dissolved in 1,200 mL of 96% ethanol. The maceration process last for 3 days, and the solution is then filtered, yielding filtrate (1) and residue (1) were obtained. Residue (1) undergo remaceration with 96% ethanol for 2 days, with occasional stirring during both processes. Filtrate (1) and filtrate (2) are combined and evaporated to obtain an extract. The extract that was obtained was 39.58 gr.

3.1 Evaluation of the quality of peel-off mask gel from corn leaf (*Zea mays* L.)

a) Organoleptic test
Organoleptic test was done to evaluate the shape, colour and smell of the samples. The result can be seen in Table 2.

Table2: Organoleptic test

Sample of*peel-off*mask gel	Shape	Colour	Smell
Basis	Semi solid	Clear	Ethanol like
F1	Semi solid	Green	Corn leaf like
F2	Semi solid	Green	Corn leaf like
F3	Semi solid	Green	Corn leaf like
F4	Semi solid	Green	Corn leaf like

Figure 1: *peel-off* gel mask from corn leaf

The organoleptic test showed that the corn leaf peel-off mask gel had a distinctive corn leaf aroma, and was green in semi-solid form. The large concentration of extract added to

the preparation will affect the colour, smell, and even the shape of the preparation itself. The greater the concentration of the extract, the thicker the mask gel will be, the aroma will be stronger, and the colour that will appear will also be more intense.

a) Homogeneity test

Homogeneity test was intended to evaluate if there were any changes of the samples during storage. Homogeneity test results can be seen in Table 3.

Table 3: Homogeneity of *peel-off* gel mask from corn leaf

Sample of*peel-off*gel mask	Observation
F1	Homogenous
F2	Homogenous
F3	Homogenous
F4	Homogenous

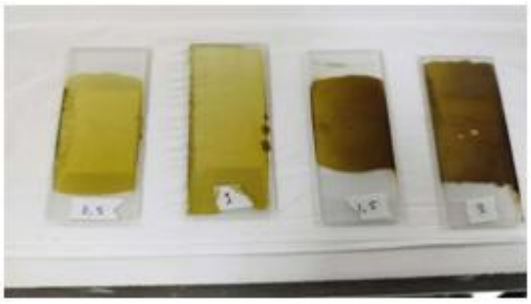

Figure2: Homogeneity of mask gel

The result shows that there is no secondary particle aggregation. A homogeneous gel resulting the spreadability of active components in the gel being equal, thus it can release active component by basis and get a good result.

b) pH test

This test was to evaluate pH from samples and to measure the pH suitability to skin. The acceptable pH of skin is5-7 [13].

Table 4: pH of *peel-off*mask gel

Sample of *peel-off* mask gel	pH (Average)
F1	7,6
F2	7,8
F3	7,8
F4	7,8

Figure 3:pH of *peel-off*mask gel

Based on the results of the tests carried out, the preparation is still within the safe limit as a topical preparation, because it is still in the pH range of 4.5 – 8 [14].

a. Spreadability

The purpose of this test is to observe the spreading ability of the corn leaf peel-off mask gel on the skin surface. The corn leaf peel-off gel mask is expected to spread easily where it is applied. Good gel spreadability is between 5-7 cm.

Table5: Spreadability of*peel-off*mask gel of corn leaf

Sample of*peel-off*mask gel	Average of spreadability (cm)
F1	5,56
F2	6,8
F3	5,30
F4	6,89

The spreadability test result of the corn leaf peel-off gel mask showed that the mask gel mask had a spreadability of 5.30-6.89 cm. The spreadability test results show that the addition of corn leaf extract meets the standards for spreading ability.

Spreadability testing describes the ability of a pharmaceutical preparation to spread when applied to the skin without applying excessive pressure, where the greater the spreadability of a preparation, the wider the contact with the skin surface thus that the absorption of the active substance will be maximized [15].

b. Pengujian waktu mengering sediaan masker gel*peel-off*daunJagung

This test was intended to evaluate how long the sample dried on the top of the skin.

Table6: Drying time of *peel-off*mask gel from corn leaf

Sample of*peel-off*gel mask	Mean of drying time (minutes)
F1	37,25
F2	35,32
F3	31,18
F4	34,09

The standard drying time for the preparation is 15-30 minutes. The drying time for the preparation is influenced by the water content in the preparation, where the amount of water content in each formula can slow down evaporation and the formation of a film layer on

the peel-off mask gel. Apart from that, the thickness of the preparation when applied to the skin will also affect the drying time of the preparation [16]. The obtained results show that the corn leaf peel-off mask gel does not meet the standard drying time.

3.2 Antioxidant test of *peel-off* gel mask from corn leaf

Antioxidant activity was evaluated using DPPH (1,1-difenil-2- pikrilhidrazil) method. Evaluation of antioxidant activity of samples was conducted on crude extract with various concentrations namely 2 ppm, 4 ppm, 6 ppm, 8 ppm dan 10 ppm. The result can be seen in Table 7.

Antioxidant tests for corn leaf peel-off mask gel were carried out on several concentrations of 0.5%, 1%, 1.5%, and 3%. The test was conducted three times in repetition. The test results can be seen in Table 8, Table 9, Table 10 and Table 11.

Table 7: Antioxidant activity of corn leaf extract

No.	Concentration(ppm)	Repetition (Absorbance)			Average (Absorbance)	% Inhibition	IC_{50} (ppm)
		R1	R2	R3			
1.	2	0,429	0,435	0,432	0,432	47,89	3,71316
2.	4	0,409	0,414	0,415	0,413	50,18	
3.	6	0,394	0,398	0,398	0,397	52,11	
4.	8	0,341	0,339	0,340	0,34	60,98	
5.	10	0,275	0,273	0,274	0,274	67.94	
6.	DPPH control	0,837	0,833	0,819	0,829	-	

Table 8: Antioxidant activity of peel-off mask gel F1 (0.5%)

No.	Concentration(ppm)	Repetition(Absorbance)			Average (Absorbance)	% Inhibition	IC_{50} (ppm)
		R1	R2	R3			
1.	2	0,452	0,457	0,458	0,456	44,99	3,70647
2.	4	0,408	0,401	0,401	0,403	51,39	
3.	6	0,361	0,365	0,366	0,364	56,09	
4.	8	0,278	0,289	0,290	0,286	65,50	
5.	10	0,175	0,183	0,184	0,181	78,17	
6.	DPPH control	0,837	0,833	0,819	0,829	-	

Table 9: Antioxidant activity of peel-off mask gel F2 (1%)

No.	Concentration(ppm)	Repetition(Absorbance)			Average (Absorbance)	% Inhibition	IC_{50} (ppm)
		R1	R2	R3			
1.	2	0,462	0,466	0,468	0,465	43,90	3,23857
2.	4	0,382	0,388	0,389	0,386	53,44	
3.	6	0,302	0,308	0,308	0,305	63,20	
4.	8	0,271	0,269	0,240	0,260	68,64	
5.	10	0,125	0,213	0,234	0,191	76,96	
6.	DPPH control	0,837	0,833	0,819	0,829	-	

Table10: Antioxidant activity of peel-off mask gel F3(1.5%)

No.	Concentration(ppm)	Repetition(Absorbance)			Average (Absorbance)	% Inhibition	IC_{50} (ppm)
		R1	R2	R3			
1	2	0,467	0,469	0,463	0,466	43,79	3,08904
2	4	0,367	0,357	0,359	0,361	56,,45	
3	6	0,279	0,298	0,298	0,292	64,78	
4	8	0,241	0,239	0,240	0,240	71,05	
5	10	0,115	0,113	0,119	0,116	86,02	
6	DPPH control	0,837	0,833	0,819	0,829	-	

Table11: Antioxidant activity of *peel-off*mask gel F4(3%)

No.	Concentration(ppm)	Repetition(Absorbance)			Average (Absorbance)	% Inhibition	IC_{50} (ppm)
		R1	R2	R3			
1	2	0,467	0,469	0,463	0,466	43,79	2,57411
2	4	0,367	0,357	0,359	0,361	56,,45	
3	6	0,279	0,298	0,298	0,292	64,78	
4	8	0,241	0,239	0,240	0,240	71,05	
5	10	0,115	0,113	0,119	0,116	86,02	
6	DPPH control	0,837	0,833	0,819	0,829	-	

The antioxidant activity of the corn leaf peel-off mask gel preparation was carried out using the DPPH method. This method was chosen for its simplicity, speed, and sensitivity, and only requires a small sample to evaluate the antioxidant activity of compounds from natural ingredients. The principle of measuring antioxidant activity using the DPPH method lies in the change in the intensity of the DPPH

purple colour, which is proportional to the DPPH concentration [20].

DPPH free radicals which have unpaired electrons, exhibit a purple colour. The colour will change to yellow when electrons pair. The shift from purple to yellow occurs due to the reduction of free radicals. It is produced by the reaction of DPPH molecules with hydrogen atoms released by molecules from the sample [20].This reaction forms diphenyl-picryl-hydrazine compounds, causing the DPPH colour to change. The colour change is measured by the absorbance at the maximum wavelength of DPPH using a UV-Vis spectrophotometer. Free radical scavenging activity is determined by an IC_{50} value [15]. This research uses vitamin C as a positive control, due to its high antioxidant activity, which can capture free radicals and prevent chain reactions.

Vitamin C belongs to the secondary antioxidant group, effectively warding off external free radicals. The free hydroxy group in vitamin C acts as a free radical quencher, and its polyhydroxy group enhance antioxidant activity [17]. Antioxidant activity is categorized based on the IC_{50} value. The smaller the IC^{50} value, the greater the antioxidant activity[15]. Antioxidant activity is categorized as very strong if the IC_{50} value is < 50 ppm, strong if the IC_{50} value is 50 – 100 ppm, moderate if the IC_{50} value is 100 – 150 ppm, and considered weak if the IC_{50} value is 150 – 200 ppm [17]

IC_{50} of corn extract was 3.71316 ppm. Meanwhile, corn leaf peel-off mask gel F1, F2, F3, and F4 were 3.70647, 3.23857, 3.08904, and 2.57411 ppm respectively. The greater the amount of extract, the greater the antioxidant value. Antioxidant activity in corn leaf peel-off mask gel is attributed to secondary metabolite compounds, particularly flavonoids. The antioxidant effectiveness of flavonoids is closely related to the side chain structure and also substitutions in the aromatic ring. The ability to react with DPPH free radicals influences the order of their antioxidant strength. Polyphenolic compounds, including flavonoids, exhibit free radical scavenging activity which is believed to be influenced by the number and position of phenolic hydrogen in the molecule [19].

Higher antioxidant activity is associated with phenolic compounds that have a greater number of hydroxyl groups in their flavonoid core. This compound can donate hydrogen, facilitating antioxidant activity in a free radical neutralization reaction that initiates the oxidation process or terminates chain radical reaction [18]. The antioxidant properties of flavonoids also stem from their ability to transfer electrons to free radical compounds and form complexes with metals. These mechanisms contribute to various effects, including inhibiting lipid peroxidation, suppressing tissue damage by free radicals, and inhibiting the activity of several enzymes. Consequently, the corn leaf peel-off gel mask preparation demonstrates antioxidant activity originating from secondary metabolite compounds, particularly flavonoids.

4. Conclusions

Corn leaf extract can be formulated into a corn leaf peel-off mask gel that meets the physical tests of the pharmaceutical preparation, including organoleptic, homogeneity, pH, and spreadability tests. Corn leaf (*Zea mays* L.) peel-off mask gel exhibits the highest antioxidant value at a concentration of 3%, namely 2.57411 ppm.

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