

Formulation and Antioxidant Activity Test of Face Mist Preparation from Red Dragon Fruit (*Hylocereus polyrhizus*) Peel Ethanol Extract Using the DPPH (2,2-diphenyl-1-picrylhydrazyl) Method

Wa Ode Ida Fitriah*, Nur Hatidjah Awaliyah Halid, Novita Mayang Sari

Department of Pharmacy, Faculty of Science and Technology, Universitas Mandala Waluya, Jl. Jend. AH. Nasution, Kambu, Kendari, Southeast Sulawesi, 93561, Indonesia

*Corresponding author: Wa Ode Ida Fitriah (waodeidafitriah1395@gmail.com)

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Abstract

The natural antioxidant potential of red dragon fruit (*Hylocereus polyrhizus*) peel is attributed to polyphenols, flavonoids, and anthocyanins, and it can be used in cosmetic formulations as an active ingredient. This research was conducted to analyze the characteristics, physical stability, and antioxidant activity of face mist preparations containing ethanol extract of red dragon fruit peel. The extract was obtained by maceration with 96% ethanol as the solvent and formulated into three concentrate levels: FI (5%), FII (10%), and FIII (15%). Evaluation of the preparations was conducted using organoleptic tests, homogeneity, pH, viscosity, drying time, spray spreadability, and cycle tests, while antioxidant activity was assessed by the DPPH method. The tested formulation exhibits physical properties within an acceptable range and stability, and shows very strong antioxidant activity, with IC₅₀ values of 29.914 µg/mL, 26.510 µg/mL, and 24.259 µg/mL, respectively. FIII (15%) exhibited the strongest antioxidant activity, indicated by the lowest IC₅₀ value. Further research is recommended to evaluate long-term stability, moisture content, and potential skin irritation to support the development of natural-based cosmetics.

Keywords: antioxidant, DPPH, face mist, *Hylocereus polyrhizus*, peel

Introduction

Indonesia has a tropical climate. Prolonged exposure to sunlight can darken the skin and lead to various skin problems, including erythema, uneven pigmentation, skin aging, and cancer risk. When UV radiation reaches the skin, free radicals are generated, which can harm skin health.¹ Free radicals are characterized by unpaired electrons, which contribute to their unstable and reactive nature. It makes them highly reactive and capable of interacting with various components of the body, such as proteins, lipids, and DNA. Motor vehicle exhaust fumes, UV radiation, and chemicals in food or medicines cause it.²

Antioxidants help stabilize free radicals by donating electrons, thereby preventing oxidative stress.³ There are two types of antioxidant compounds: natural and synthetic. The use of synthetic compounds can cause lung and liver problems and damage to the intestinal mucosa. Consuming large doses over a long period of time can cause toxic

effects and increase the risk of cancer. Therefore, preparations are being developed to support these effects by utilizing natural substances.⁴ One of the sources of natural antioxidants comes from the peel of red dragon fruit, which contains vitamins A, C, and E, as well as flavonoids, alkaloids, phenolic compounds, thiamine, terpenoids, niacin, cobalamin, pyridoxine, phytoalbumins, and carotene.⁵ The antioxidant potency of red dragon fruit peel extract was reported to have an IC_{50} value of 2.6949 $\mu\text{g/mL}$, indicating a highly potent effect. Compounds with lower IC_{50} values are more likely to exhibit antioxidant activity.⁶ In a previous study on the antioxidant activity of red dragon fruit peel (*Hylocereus polyrhizus*) extract at concentrations of 5%, 10%, and 15% in a lip balm formulation, Formula III (15%) demonstrated very strong antioxidant activity, with an IC_{50} value of 42.84 $\mu\text{g/mL}$. In contrast, Formula I (5%) and Formula II (10%) showed significant antioxidant activity, with IC_{50} values of 62.25 $\mu\text{g/mL}$ and 59.87 $\mu\text{g/mL}$, respectively.⁷ Based on previous studies, the researcher selected concentration variations of 5%, 10%, and 15% as references for formulating the preparation in the form of a face mist.

Face mist is a product that helps keep the facial skin hydrated and maintain a youthful appearance. When sprayed, it produces fine particles that are easily absorbed by the skin. Face mist is convenient to use and carry, and it also helps reduce the risk of contamination.⁸ Furthermore, this dosage form has better diffusion into the skin compared to other forms due to its low and fluid viscosity. In addition to refreshing the face, face mist also acts as a mild disinfectant and can help tighten the skin pores.⁹

This research presents an innovation by utilizing red dragon fruit peel, which is generally underutilized in functional cosmetic products such as face mist and remains underexplored compared to other topical preparations. In addition, this study specifically assessed the impact of a 5%, 10%, and 15% extract concentration on the characteristics, physical stability, and antioxidant activity using the DPPH method, so that it can provide information on the most optimal and effective formulation as a natural-based skin care preparation, making it shorter.

Method

Instrument

The instruments used included a blender (Miyako[®]), sieve (Krisbow[®]), stirring rod (Pyrex[®]), maceration container (Lion Star[®]), erlenmeyer flask (Pyrex[®]), porcelain dish (Haldenwanger[®]), measuring cylinder (Pyrex[®]), universal pH indicator (Merck[®]), mortar and pestle (Haldenwanger[®]), watch glass (Pyrex[®]), measuring pipette (Pyrex[®]), beaker (Pyrex[®]), viscometer (Brookfield[®]), dropper pipette (Onemed[®]), UV-Vis spectrophotometer (Shimadzu UV-1280[®]), and face mist containers (Aptar Beauty[®]).

Material

The materials used included red dragon fruit peel extract obtained from North Buton Regency, Southeast Sulawesi Province, distilled water (Brataco[®]), glycerin (Brataco[®]), methyl paraben (Brataco[®]), propylene glycol (Brataco[®]), 95% ethanol (OneMed[®]), 70% ethanol (OneMed[®]), oleum rosae (Brataco[®]), filter paper (Whatman[®]), parchment paper (Sidu[®]), DPPH powder (Sigma-Aldrich[®]), vitamin C powder (IPI[®]), and a positive control face mist (Herborist Aloe Vera Face Mist).

Procedure

Sample Preparation

The first step in sample processing is to collect fresh, ripe red dragon fruit (*Hylocereus polyrhizus*) peels, characterized by an even, bright red skin color, a texture that is neither too hard nor too soft, and no damage or rotten spots on the skin surface. A total of ± 2 kg of dragon fruit peel is washed using running water to remove any dirt, then drained. While still damp, wet sorting is carried out to separate unwanted materials from the crude drug. Next, cut into small pieces for a more even drying process, then air- and sun-dry in indirect sunlight for 3–5 days at an ambient temperature of around 28–32°C, until the water content decreases and the material becomes dry and brittle. Next, the simplisia is dried either under sunlight or air-dried, with or without direct sun exposure. Once completely dry, the simplisia is collected and stored in a closed container to obtain the final simplicia.

Maceration Method

To obtain the base extract from red dragon fruit peel, the crude drug was macerated using 96% ethanol. A total of 700 grams of red dragon fruit peel (*Hylocereus polyrhizus*) was placed in a container, and then 3.5 L of 96% ethanol was added at a 1:5 (w/v) ratio. The container was tightly sealed and left for 72 hours, with occasional stirring to ensure a uniform extraction. The solvent was changed every 24 hours. After the maceration process was complete, the mixture was filtered through filter paper to obtain a liquid filtrate. Rotary evaporation of the filtrate was performed at 70°C, resulting in a concentrated extract with a thick consistency. The filtrate was evaporated at 70°C to obtain a thick extract.¹⁰

Face Mist Formulation

Details of the face mist formulation incorporating red dragon fruit peel extract are provided in Table 1.

Table 1. Face Mist Formula

Composition	Formula % w/w				Function
	F0	FI	FII	FIII	
Red dragon fruit peel extract (<i>Hylocereus polyrhizus</i>)	0	5%	10%	15%	Active Pharmaceutical Ingredients
Glycerin	10%	10%	10%	10%	Humectant
Propylene glycol	4%	4%	4%	4%	Emollient
Methyl paraben	0,2%	0,2%	0,2%	0,2%	Preservative
Oleum rosae	5 drops	5 drops	5 drops	5 drops	Fragrance
Aquadest	ad 60 mL	ad 60 mL	ad 60 mL	ad 60 mL	Solvent

Note :

F0: Negative control without extract

Evaluation of Face Mist Formulation

Organoleptic Test

The formulation was characterized by organoleptic assessment of its appearance, texture, color, and odor.¹¹

Homogeneity Test

To ensure that the particles in the formulation were evenly mixed, a homogeneity test was conducted by visual inspection. The face mist sample was placed on a clear surface or glass plate. The formulation must have a consistent composition and contain no coarse particles.¹²

Viscosity Test

A Rion viscometer was used to measure the viscosity of the formulation. The device was equipped with spindle No. 1, which was inserted into the sample until it reached a designated point. The resulting viscosity readings were then recorded.¹¹

pH Test

The formulation's acidity was determined by pH analysis, as very low pH levels may cause skin irritation. SNI 16-4399-1996 classifies face mist formulations with a pH of 4.5–8.0 as acceptable.¹³ To measure the pH of the face mist formulation, a pH meter was inserted into the solution, which then displayed the pH value.

Drying Time Test

The drying time test measures how long it takes for the face mist to dry or absorb into the skin. The ideal drying time is less than five minutes.

Spray Spread Test

From a distance of 5 cm, the container sprays the face mist onto a sheet of paper. The optimal spray diameter for the face mist is between 5 and 7 cm. A wider spray diameter facilitates the penetration or diffusion of active chemical compounds through the skin.¹⁴

Stability Test

The cycling test accelerates the physical stability assessment of the formulation and was conducted over six cycles spanning 12 days. The face mist was stored for 24 hours at approximately 4°C before being transferred to around 40°C. This process constitutes a single cycle in which the formulation's physical properties are compared with those of the previous stage of the experiment. Before and during the test, stability evaluations were conducted on the formulation to examine its organoleptic properties, homogeneity, pH, and viscosity.¹⁵

Antioxidant Activity Test

Preparation of 100 ppm DPPH Stock Solution

10 mg of DPPH powder was placed into a 100 mL volumetric flask, then 70% ethanol was added up to the calibration mark. The flask was shaken to mix the solution thoroughly. Aluminum foil was used to cover the flask, and it was left to stand for 30 minutes.

Preparation of 100 ppm Stock Solution of the Formulation

10 mg of each red dragon fruit peel extract face mist formulation was placed into a 100 mL volumetric flask. Then, 70% ethanol was added up to the calibration mark, and the mixture was stirred until homogeneous.

Preparation of Serial Solutions of the Formulation

Several 10 mL solutions were prepared at concentrations of 5 ppm, 10 ppm, 15 ppm, 20 ppm, and 25 ppm by taking 0.5 mL, 1 mL, 1.5 mL, 2 mL, and 2.5 mL of the stock solution and transferring them into 10 mL volumetric flasks. Then, 70% ethanol was added up to the calibration mark, and the solutions were mixed thoroughly. Afterward, 1 mL of each solution was placed into test tubes, followed by the addition of 1 mL of DPPH solution.

Preparation of 100 ppm Vitamin C Stock Solution

10 mg of vitamin C was placed into a 100 mL volumetric flask. 70% ethanol was added to the flask, and the mixture was stirred until completely dissolved. The solution was then adjusted to concentrations of 5, 10, 15, 20, and 25 ppm. Using a pipette, 0.5 mL, 1 mL, 1.5 mL, 2 mL, and 2.5 mL of each concentration were transferred into a container and diluted to a final volume of 10 mL.

Preparation of Serial Vitamin C Solutions

To prepare several 10 mL vitamin C solutions at concentrations of 5, 10, 15, 20, and 25 ppm, 0.5 mL, 1 mL, 1.5 mL, 2 mL, and 2.5 mL of the stock solution were added to 10 mL volumetric flasks. Then, 70% ethanol was added and mixed thoroughly. Finally, 1 mL of each sample and 1 mL of DPPH solution were transferred into test tubes.

Determination of Antioxidant Activity Strength

The maximum wavelength of the DPPH solution was first determined using a UV-Vis spectrophotometer, yielding 517 nm. The sample absorbance was then measured at this wavelength to determine the sample's ability to reduce DPPH free radicals. The percentage inhibition value of DPPH free radicals (% inhibition) was then determined using the following equation. For more information, see the following equation:¹⁶

$$\% \text{ Inhibition} = \frac{\text{blank absorbance} - \text{sample absorbance}}{\text{blank absorbance}} \times 100\%$$

IC₅₀, or the 50% inhibitory concentration, indicates the amount of extract required to neutralize half of the DPPH radicals. This value is expressed in µg/mL. The test was conducted using three face mist formulations, with vitamin C serving as a reference. The calculated percentage inhibition values were then plotted against concentration to generate a linear regression equation, which was subsequently used to determine the IC₅₀ value:¹⁶

$$y = ax + b$$

This equation explains that y indicates the percentage of antioxidant activity, x indicates the concentration of the test solution, a is the slope value of the line (slope), and b is the intercept value.

Result

Extraction Results

Table 2 presents the extraction results of red dragon fruit peel (*Hylocereus polyrhizus*).

Table 2. Extraction Results of Red Dragon Fruit Peel (*Hylocereus polyrhizus*)

Solvent	Weight of Simplisia	Extract Weight	Yield (%)	Organoleptic
Ethanol 96%	700 g	78 g	11,14%	Color: Yellowish-brown Odor: Characteristic of the extract Form: Viscous

Organoleptic Test Results

Organoleptic observation results of the face mist formulation during 4 weeks are presented in Table 3.

Table 3. Organoleptic Observation Results of Face Mist Formulation During 4 Weeks

Formula	Observation by Week		
	Color	Odor	Form
K+	Transparant	Characteristic aloe vera scent	Liquid
F0	Transparant	Characteristic fragrance	Liquid
FI (5%)	Yellowish-brown	Characteristic fragrance	Liquid
FII (10%)	Light brown	Characteristic fragrance	Liquid
FIII (15%)	Dark brown	Characteristic fragrance	Liquid

Note :

K+: Aloe vera face mist formulation

F0: Negative control without extract

Homogeneity Test Results

Homogeneity observation results for the face mist formulation over 4 weeks are presented in Table 4.

Table 4. Homogeneity Observation Results of Face Mist Formulation

Formula	Observation by Week			
	I	II	III	IV
K+	✓	✓	✓	✓
F0	✓	✓	✓	✓
FI (5%)	✓	✓	✓	✓
FII (10%)	✓	✓	✓	✓
FIII (15%)	✓	✓	✓	✓

Note :

K+: Aloe vera face mist formulation

F0: Negative control without extract

✓ : Homogeneous

Viscosity Test Results

Viscosity Observation Results (dPas) of Face Mist Formulation during 4 weeks are presented in Table 5.

Table 5. Viscosity Observation Results (dPas) of Face Mist Formulation

Formula	Observation by Week			
	I	II	III	IV
K+	3	3	3	3
F0	2	2	2	2
FI (5%)	2	2	2	2
FII (10%)	2	2	2	2
FIII (15%)	2	2	2	2

Note :
 K+: Aloe vera face mist formulation
 F0: Negative control without extract

pH Test Results

pH observation results of face mist formulation during 4 weeks are presented in Table 6.

Table 6. pH Observation Results of Face Mist Formulation

Formula	Observation by Week			
	I	II	III	IV
K+	7	7	7	7
F0	6	6	6	6
FI (5%)	6	6	6	6
FII (10%)	5	5	5	5
FIII (15%)	5	5	5	5

Note :
 K+: Aloe vera face mist formulation
 F0: Negative control without extract

Drying Time Test Results

Drying time observation results (minutes/seconds) of face mist formulation during 4 weeks are presented in Table 7.

Table 7. Drying Time Observation Results (Minutes/Seconds) of Face Mist Formulation

Formula	Observation by Week			
	I	II	III	IV
K+	2,15	2,15	3,20	3,20
F0	2,19	2,19	3,32	3,32
FI (5%)	2,27	2,27	3,46	3,46
FII (10%)	2,34	2,34	3,49	3,49
FIII (15%)	3,11	3,11	4,10	4,10

Note :
 K+: Aloe vera face mist formulation
 F0: Negative control without extract

Spray Spread Test Results

Spray spread observation results for the face mist formulation over 4 weeks are presented in Table 8.

Table 8. Spray Spread Observation Results of Face Mist Formulation

Formula	Observation by Week			
	I	II	III	IV
K+	6	6	6	6
F0	6	6	6	6
FI (5%)	6	6	6	6
FII (10%)	5,5	5,5	5,5	5,5
FIII (15%)	5	5	5	5

Note :

K+: Aloe vera face mist formulation

F0: Negative control without extract

Stability Test Results (Cycling Test)

Stability observation results for the face mist formulation before and after the cycling test are presented in Table 9.

Table 9. Stability Observation Results of Face Mist Formulation Before and After Cycling Test

Storage Conditon	Parameter	F0	FI	FII	FIII
4°C and 40°C	Color	Transparant	Yellowish -brown	Light brown	Dark brown
	Odor	Fragrance	Fragranc e	Fragrance	Fragrance
	Form	Liquid	Liquid	Liquid	Liquid
	pH	6	6	5	5
	Homogenity	Homogen eous	Homogen eous	Homogeneous	Homogeneous
	Viscosity	2	2	2	2

Antioxidant Activity Test Results

Table 10. shows the antioxidant activity test results of the face mist spray prepared using ethanol extract of red dragon fruit peel (*Hylocereus polyrhizus*).

Table 10. Antioxidant Activity Test Results of Face Mist Formulation

Sample	Concentration (ppm)	Blank absorbance	Sample absorbance	% Inhibition	IC ₅₀ (µg/mL)
FI (5%)	5		0,768	13,318	29,914
	10		0,715	19,300	
	15	0,886	0,689	22,234	
	20		0,615	30,586	
	25		0,469	47,065	
FII (10%)	5		0,812	8,352	26,510
	10		0,645	27,200	
	15	0,886	0,587	33,747	
	20		0,543	38,713	
FIII (15%)	25		0,489	44,808	24,259
	5		0,593	33,069	
	10		0,564	36,343	
	15	0,886	0,520	41,309	
	20		0,481	45,711	

Table 10. (Extension)

Sample	Concentration (ppm)	Blank absorbance	Sample absorbance	% Inhibition	IC ₅₀ (µg/mL)
Vitamin C	25		0,432	51,241	11,140
	5		0,765	13,656	
	10		0,439	50,451	
	15	0,886	0,173	80,474	
	20		0,096	89,164	
	25		0,084	90,519	

Discussion

The red dragon fruit peel (*Hylocereus polyrhizus*) used as the research specimen was obtained from Sara'Ea Village, Kulisusu District, North Buton Regency, Southeast Sulawesi. This study aimed to develop a face mist using the ethanol extract of red dragon fruit peel (*Hylocereus polyrhizus*), which is known for its excellent physical stability and potent antioxidant properties. The dragon fruit peel was chosen as the research sample because it is underutilized and often discarded as waste, yet it possesses antioxidant activity due to its polyphenol content. The maceration procedure yielded 700 grams of red dragon fruit peel powder. Maceration was easy to perform because it does not require specialized equipment and is effective for heat-sensitive materials. A 96% ethanol solution was used as the solvent because phenolic compounds are highly soluble in polar liquids.¹⁷ 96% ethanol was chosen because it is non-toxic, selective, easily absorbed, and has a high extraction capacity, meaning it can extract polar, semi-polar, and non-polar compounds.¹⁸ To accelerate the thickening process, the liquid extract was placed in a rotary evaporator at 70°C until it became concentrated. The red dragon fruit peel extract was yellowish-brown, had a strong odor, and was viscous. In this study, 78 grams of thick extract were obtained, yielding 11.14% (Table 2). Furthermore, a yield is considered acceptable if it exceeds 10%, meaning that the yield obtained in this study successfully met the criteria set by the Indonesian Herbal Pharmacopeia.¹⁹ A good yield indicates that the active compounds from red dragon fruit peel were optimally extracted and have the potential to provide higher biological activity in the face mist preparation.¹⁹

The initial formulation indicated that the red dragon fruit peel extract face mist would also contain glycerin, propylene glycol, methylparaben, distilled water, and oleum rosae. Glycerin is used as an emollient that can enhance skin smoothness and softness. Emollients are added to the product to help maintain skin hydration when applying cosmetics.²⁰ Because it can absorb water, is water-soluble, and is easily applied to the skin, propylene glycol functions as a humectant. Propylene glycol also enhances the solubility of other substances, making it commonly used in topical products due to its relatively low toxicity.²¹ Methylparaben is an important component of the face mist formulation because it prevents the solution from being contaminated by bacteria and other microorganisms. Distilled water is used as a solvent to help dissolve the ingredients.²² Oleum rosae is used as a fragrance agent.²³

Based on the observations in Table 3, the organoleptic test results over four weeks for the positive control and the four formulations showed that F0 (without extract) was clear, had a characteristic fragrance, and was liquid. F1, containing 5% extract, was yellowish-brown, had a characteristic odor, and was in liquid form. FII (10% extract concentration) was light brown, had a strong odor, and was liquid. FIII (15% extract concentration) was dark brown, had a strong odor, and was liquid. Organoleptic test results showed that all three blends produced a stable face mist product over four weeks of storage. Each formula appears in a different color due to the extract's increased concentration. The formula with a higher extract concentration produced a darker color and a more intense aroma.

Based on Table 4, the homogeneity test of face mist formulations over a four-week observation period showed that the positive control and all formulations were homogeneous. No coarse particles, clumps, or color differences were observed on the glass plate. It indicates that all three formulations were evenly distributed. Therefore, the formulations in this study are considered to be stable and homogeneous. Homogeneity stability also indicates that the formula's ingredient combination can maintain system stability during storage.

The viscosity test results for the red dragon fruit peel extract face mist are shown in Table 5 and remained unchanged throughout the four-week observation period. The measured viscosity was 3 dPas for the positive control, whereas all formulations had a viscosity of 2 dPas. The resulting viscosity falls within the optimal range for face mist formulations, which is below 5 dPas.¹¹ If a spray formulation has a viscosity higher than 5 dPas, its particles will become uneven and thick, causing the spray to distribute unevenly on the skin. Storage temperature affects viscosity. A relatively low viscosity offers the practical advantages of easier spraying and more uniform distribution of the liquid on the skin's surface. Formulas with too high a viscosity can produce large, uneven droplets, reducing application comfort. Conversely, a viscosity that is too low can cause the product to drip quickly, reducing application efficiency. Therefore, a viscosity of 2 dPas in the extract formula is considered optimal for achieving a light, comfortable sensation when used as a face mist.²⁴

Based on the observations in Table 6, the pH test results over four weeks were obtained at F0, FI, FII, and FIII, all of which met the required standards. The optimal pH range for facial skin is between 4.5 and 6.5.²⁰ SNI 16-4399-1996 states that the pH value for face mist formulations should be between 4.5 and 8.0. The measured values fall within this range.¹³ The pH test examines whether the pH level of the face mist formulation matches that of the skin.²⁵ Observations indicate that the formula is safe to use and may minimize the risk of skin irritation. A suitable pH is crucial for maintaining a stable skin barrier, as products with a pH that is too acidic or alkaline can cause dryness, irritation, or even peeling.²⁰ Therefore, pH stability during storage is an important indicator that the formula has good compatibility with the skin.

The drying time test results for all formulations over four weeks (Table 7) showed changes during the third and fourth weeks. However, these changes still meet the requirement that the face mist dries in less than five minutes. Changes in drying time may be influenced by storage conditions and air exposure, which can alter the preparation's water content.²⁶ However, these changes are still within acceptable limits, so they do not significantly affect the quality of product use.

The spray spread of the positive control and all formulas during the 4-week observation period had an average diameter of 6 cm for the positive control, 6 cm for F0, 6 cm for FI, 5.5 cm for FII, and 5 cm for FIII (Table 8). The spray area was within the ideal range of 5-7 cm. The facial spray had a good spray area of 5-7 cm.²⁷ The wide spray area allows for optimal distribution of the active ingredients over the skin's surface, increasing effectiveness. Formulas with higher extract concentrations showed a slight decrease in spray diameter, likely due to increased viscosity. Nevertheless, the results still met the criteria for a good face mist.

The physical stability of the face mist formulation was evaluated using a cycling test that subjected the product to alternating temperatures of 4°C and 40°C. This procedure was designed to mimic temperature fluctuations that may occur during storage and to assess the formulation's stability under such conditions. Based on the cycling test results in Table 9, all formulas remained stable at 4°C and 40°C, with no significant changes in color, odor, shape, or pH. This stability indicates that the formulations can maintain their physical quality under extreme temperature conditions that may occur during product distribution and storage.²⁷ From the cycling test results in Table 9, all

formulas remained stable at 4°C and 40°C without significant changes in color, odor, appearance, or pH. This stability indicates that the formulations can maintain their physical quality under extreme temperature conditions that may occur during product distribution and storage.²⁷ Good stability is crucial in cosmetic development because it can extend shelf life and ensure product quality until it reaches consumers.

All formulations demonstrated highly potent antioxidant activity, as evidenced by IC₅₀ values below 50 µg/mL in the DPPH assay (Table 10). Formula I had a concentration of 29.914 µg/mL, Formula II had a concentration of 26.510 µg/mL, Formula III had a value of 24.259 µg/mL, and Vitamin C (positive control) had a concentration of 11.140 µg/mL. The IC₅₀ value of 24.259 µg/mL obtained for Formula III suggests a higher radical-scavenging capacity than that observed in the other formulations. However, it was still lower than the vitamin C positive control. These results indicate that increasing extract concentration is directly proportional to increasing antioxidant activity.¹⁶ Practically, the IC₅₀ value indicates that the red dragon fruit peel extract face mist has the potential to be used as an antioxidant cosmetic to help protect the skin from free radical exposure caused by UV rays and environmental pollution. Furthermore, compared to several other natural antioxidant active ingredients in cosmetic products, the IC₅₀ value, which is in the very strong category, indicates that red dragon fruit peel extract has competitive potential as a natural cosmetic active ingredient.⁶ The resulting activity is triggered by the presence of phenolic compounds and flavonoids in the extract. These compounds work by donating electrons or hydrogen atoms to free radicals, thereby stabilizing them and halting oxidative chain reactions. The reduction in IC₅₀ observed at higher extract levels may be attributed to the increased presence of antioxidant substances that effectively counteract free radicals.¹⁷

Although the study yielded promising results, several limitations remain, including potential variations in the content of active compounds in red dragon fruit peel due to environmental and postharvest factors. In addition, the stability test was conducted for only 4 weeks, and no skin irritation or in vivo tests were conducted, so the safety and long-term stability of the product cannot be fully confirmed. Therefore, further research is needed, including standardization of raw materials, long-term stability tests, microbiological tests, and safety evaluations, to improve the quality and effectiveness of the face mist preparation.

Conclusion

A face mist formulation containing ethanol extract of red dragon fruit peel (*Hylocereus polyrhizus*) at concentrations of 5%, 10%, and 15% demonstrated physical evaluation results that met the requirements and exhibited sufficiently high antioxidant activity. Among all the formulations tested, the 15% extract formulation yielded the best results, with an IC₅₀ of 24.259 µg/mL, indicating the strongest free-radical scavenging ability compared to the other formulations.

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