MEDALION JOURNAL: Medical Research, Nursing, Health and Midwife Participation | ISSN (e): 2986-7754
Volume 7 No 2 (2026)

Comparison of Lipstick Preparation Formulations of Red Dragon Fruit Extract (Hylocereus polyrhizus) and *Aloe vera* Extract (*Aloe vera* L.) as a Lip Colorant and Moisturizer with Lipstick Preparations Without Extracts

Athaya Wijdan Pascadiksa[1], Fitra Kamila Rahma[2], Elvina Widyasari Amarylis[3], Verna Wimala Salsabila[4], Dzikrina Adibah Salma[5]
[12345]Department of Pharmacy, Semarang State University
Email :[1]athayawijdanp@students.unnes.ac.id, [2]fitrakamilarahma21@students.unnes.ac.id, [3]elvinawidyasari@students.unnes.ac.id, 4salsabilaverna@students.unnes.ac.id, [5]salma157@students.unnes.ac.id

Received	: 01-06-2026	Published	: 30-06-2026
Revised	: 02-06-2026	DOI	: https://doi.org/10.59733/medalion.v7i2.308
Accepted	: 29-06-2026	Publish Link	:https://medalionjournal.com/index.php/go

Abstract
Lipstick is a type of cosmetic widely used to beautify the appearance of the lips. Excessive use of artificial colors can cause irritation, so safer natural ingredients are needed. Red dragon fruit peel (*Hylocereus polyrhizus*) contains natural dyes betacyanin which has the potential as a natural dye and antioxidant, while *Aloe vera* acts as a natural moisturizer. This study aims to explore the potential of red dragon fruit peel extract and *Aloe vera* in making lipstick and assess its physical quality and antioxidant activity. The research methodology includes dragon fruit peel extraction using maceration techniques and *Aloe vera* extraction using infundation methods, which are then formulated into lipstick with cera alba, carnauba wax, cetyl alcohol, and vaseline album as the base ingredients. Product evaluation includes organoleptic tests, pH, homogeneity, spreadability, hardness, irritation, melting point, weight uniformity, cyclic stability testing, and antioxidant activity using the DPPH method. The results showed that the lipstick formula using the extract produced a bright red color, a pH of 5, was stable at extreme temperatures, non-irritating, and had an antioxidant activity of 1.13 mgQE/g. It is hoped that this research can provide an alternative for the development of natural-based cosmetics that are safe, environmentally friendly, and provide antioxidant and moisturizing benefits to the lips.

Keywords: Lipstick, Red Dragon Fruit Peel, Aloe Vera, Antioxidants, Natural Cosmetics

INTRODUCTION

Cosmetics are a product that continues to evolve along with the increasing public demand for personal care and appearance. Lipstick is one of the most widely used decorative cosmetic products, thanks to its ability to provide color, enhance the appearance of the lips, and boost the user's self-confidence. Lipstick is generally composed of a mixture of waxes, oils, fats, dyes, and other additives that function to form a solid texture and facilitate application to the lips (Athaillah *et al*., 2023). However, the use of synthetic dyes in lipstick preparations remains a concern because some synthetic dyes are known to have the potential to cause irritation and toxicity if used excessively over the long term. Therefore, the use of natural ingredients as alternative dyes and active cosmetic ingredients has become one of the innovations widely developed in the pharmaceutical and cosmetology fields.

One natural ingredient that has the potential to be used as a natural dye in lipstick preparations is the red dragon fruit peel (*Hylocereus polyrhizus*). Red dragon fruit peel contains betacyanin pigments, which belong to the betalain group and produce a natural purplish red color. In addition to functioning as

a dye, dragon fruit peel is also rich in phenolic compounds, flavonoids, vitamins, and antioxidants that can help protect cells from damage caused by free radicals (Martinez *et al*., 2024). This antioxidant activity makes dragon fruit peel not only serve as a decorative material but also has functional benefits in maintaining healthy lip skin. Based on research by Nurman *et al*. (2019), red dragon fruit peel extract has an IC50 value of 54.12 ppm, which is categorized as a strong antioxidant. This value indicates that red dragon fruit peel has great potential to be developed as an active ingredient in natural cosmetics, especially in lipstick formulations.

In addition to natural dyes, lipstick preparations also require ingredients that can maintain lip moisture to prevent drying and chapping. One natural ingredient widely used as a moisturizer is aloe vera. *Aloe vera* contains lignin and polysaccharides that can maintain water levels on the skin's surface, making it effective as a natural moisturizer. *Aloe vera* is also known to have a calming effect, aiding the skin regeneration process, and is safe for topical use in various cosmetic and pharmaceutical preparations (Ramadhina *et al*., 2025). The use of *Aloe vera* in lipstick formulations is expected to increase comfort while providing protection for lips from dry conditions caused by environmental exposure.

From a pharmacological perspective, the combination of red dragon fruit peel extract and *Aloe vera* has synergistic potential in lipstick preparations. Betacyanin in dragon fruit peel acts as a natural antioxidant that can help reduce oxidative damage to the skin of the lips, while *Aloe vera* works as a moisturizer that maintains lip hydration and elasticity. Furthermore, *Aloe vera* is known to have a healing effect on minor wounds and protection against skin irritation, thus supporting long-term use in lip cosmetics (Safitri *et al*., 2022). The combination of these two ingredients is usefull because it not only produces a decorative cosmetic product but also provides lip care benefits simultaneously.

From a pharmacokinetic perspective, betalain pigments, particularly betacyanins, are known to have low systemic bioavailability and limited absorption. These compounds do not readily accumulate in the body due to biotransformation and are excreted primarily in the urine in small amounts (Martinez *et al*., 2024). These characteristics support the safe use of betacyanins as natural dyes in topical preparations such as lipstick because their effects are predominantly local on the surface of the lips. Meanwhile, *Aloe vera* has good penetration into the skin layer due to its lignin content, which helps retain moisture and reduce fluid loss at the skin's surface. The use of *Aloe vera* in topical preparations focuses more on local effects than systemic absorption, making it relatively safe for use as a lip moisturizer (Safitri *et al*., 2022).

In lipstick formulation, the selection of excipients is also a crucial factor in determining the physical quality and stability of the product. Lipstick bases generally consist of a combination of waxes, oils, and fats with different melting points. Cera alba is used as a hardener and structuring agent for lipsticks because it produces a soft, easy-to-apply texture. Carnauba wax is used to increase the hardness and stability of the melting point, preventing the lipstick from melting easily at high temperatures. Vaseline album acts as both a base and an emollient, helping to maintain lip moisture. Cetyl alcohol is also used as an emulsifier to help homogenize the mixture of oil and liquid extract phases, resulting in a more stable product (Vinaeni *et al*., 2022). Nipagin is added as a preservative to prevent microbial growth, while BHT is used as a synthetic antioxidant to maintain the product's stability against oxidation (Gultom & Ginting, 2018). Selecting the right excipient is crucial because it can affect the homogeneity, spreadability, stability, and final quality of the lipstick.

The lipstick dosage form was chosen because it is the most suitable form of decorative cosmetics for applying the natural dye from red dragon fruit peel. In addition to enhancing lip color, lipstick also allows direct contact of the active ingredients with the lip surface, thus optimally achieving antioxidant and

moisturizing benefits. The use of lipstick also provides added value by utilizing natural ingredients as a safer and more environmentally friendly alternative to synthetic dyes. With the increasing trend of natural cosmetics, the development of a lipstick based on red dragon fruit peel extract and *Aloe vera* is relevant for further study.

Several previous studies have explored the use of dragon fruit peel as a natural dye and antioxidant source in cosmetic preparations. Other studies have also developed *Aloe vera* as a moisturizing ingredient in skincare products. However, research on the combination of red dragon fruit peel extract and *Aloe vera* in lipstick formulations is still relatively limited, particularly those examining pharmacology, pharmacokinetics, excipient selection, and a comprehensive evaluation of the physical quality of the preparation. Furthermore, the use of natural dyes still faces several challenges such as low color stability, poor homogeneity of the preparation, and suboptimal spreadability (Dwiki *et al*., 2018). This indicates a research gap that still needs to be developed to obtain a natural lipstick formulation with good and stable quality.

Based on these problems, this study offers a solution in the form of a lipstick formulation based on red dragon fruit peel extract as a natural colorant and antioxidant combined with *Aloe vera* as a natural moisturizer. The use of this combination of natural ingredients is expected to produce a safer lipstick preparation, possess antioxidant activity, be able to maintain lip moisture, and meet the requirements for physical evaluation of cosmetic preparations. This research is important to support the development of natural cosmetics that are safe, effective, and have high economic value through the utilization of dragon fruit peel waste, which has not been optimally utilized.

The objectives of this study were to determine the potential of red dragon fruit peel extract and *Aloe vera* in lipstick formulations, evaluate their pharmacological and pharmacokinetic aspects, analyze the rationale for selecting excipients and dosage forms, and assess the physical quality and antioxidant activity of the resulting lipstick. This study also aimed to produce a natural lipstick formulation that meets cosmetic quality requirements and is safe to use.

The results of this study are expected to benefit the development of cosmetic pharmaceutical science, particularly in the use of natural ingredients as active ingredients and natural dyes in decorative preparations. Furthermore, this research is expected to serve as a reference for further research on natural cosmetic formulations and provide benefits to the public by providing safer, more environmentally friendly alternative lipstick products with added functional value as antioxidants and lip moisturizers.

METHOD

Tools and materials

The tools used in making lipstick are blender, mori cloth, a set of laboratory glassware, dropper pipette, micropipette, knife, hot plate, water bath, oven, vial bottle, pH meter, lipstick mold, UV-Vis spectrophotometry. The materials used are red dragon fruit, aloe vera, 96% ethanol, distilled water, HCl, NaOH, 72% H_2SO_4, cera alba, carnauba wax, cetyl alcohol, nipagin, vaseline album, 2% citric acid, allura red AC, 0.05 M DPPH solution.

Making Dragon Fruit Peel and *Aloe vera* Extract

The dragon fruit peels were extracted using a maceration method. Before maceration, the dragon fruit peels were washed, and 2.5 kg of them were ground in a blender until they became a pulp. The

maceration was carried out using 96% ethanol at a ratio of 1:10 for 24 hours. The filtrate was then filtered and evaporated at room temperature to form a thick extract.

Aloe vera is extracted using the infundation method. Two kilograms of *Aloe vera* is cleaned and the gel is extracted by peeling the skin and rinsing with water. It is then ground and filtered. The *Aloe vera* gel is then heated at 90°C for 15 minutes.

Lipstick Preparation Formulation

Table 1 Red Dragon Fruit & *Aloe vera* Extract Lipstick Formula

Material	Formula 1	Formula 2	Function
Red dragon fruit peel extract	18%	-	Active Coloring Substance
Aloe vera extract	3%	-	Moisturizing Active Ingredients
Cera alba	15%	15%	Stiffening agent
Carnauba wax	10%	10%	Coating agent
Cetyl alcohol	2%	2%	Emollient
Nipagin	0.18%	0.18%	Preservative
BHT	0.05%	0.05%	Lipstick base
Vaseline album	Ad 100	Ad 100	Antioxidants
Allura Red AC	q.s	q.s	Additional coloring

Making Lipstick Preparations

Red dragon fruit extract and *Aloe vera* are mixed to form mixture A. The lipstick base consisting of cera alba, carnauba wax, cetyl alcohol, and vaseline album is melted at 80°C until homogeneous to form mixture B. The two mixtures are then mixed evenly, nipagin and allura red AC are added, then put into a mold and cooled to form a lipstick stick.

Preparation Evaluation Test

The evaluation tests for the preparation included organoleptic tests to observe the shape, color, and aroma of the lipstick. The pH test was performed using indicator paper after the preparation was melted. The homogeneity test was performed by applying the preparation to a glass object and observing it visually. A smear test was performed on the skin to observe the spreadability, color evenness, and adhesion. The melting point test was performed by gradually heating until the lipstick melted, while the hardness test was performed by applying a graduated load until the lipstick broke. The irritation test was performed on the skin of the arm for 3 consecutive days to observe any irritation reactions. The stability test was performed at cold and hot temperatures for 3 cycles by observing the physical changes in the preparation. The weight uniformity test was carried out by weighing three lipstick sticks and calculating their average weight.

Antioxidant Test

Antioxidant testing was performed using the DPPH method with a standard 100 ppm vitamin C solution diluted to several concentrations. Each solution was mixed with 50 ppm DPPH, then incubated for 30 minutes in the dark, and its absorbance was measured using a UV-Vis spectrophotometer at a wavelength of 517 nm. Lipstick samples at a concentration of 1000 ppm were tested using the same procedure to determine their antioxidant activity.

RESULTS AND DISCUSSION

This study aims to determine the formulation and feasibility of a natural-based lipstick preparation consisting of red dragon fruit peel extract and *Aloe vera* extract through an evaluation of the preparation. Lipstick is a cosmetic widely used to enhance the appearance of the lips and is composed of a mixture of oils, waxes, and fats that provide a dense texture and facilitate application (Athailah *et al*., 2023).

Dragon fruit peel extract is used because it contains antioxidants, antiproliferatives, and anthocyanins, which have the potential to act as natural colorants in lipstick. Antioxidants are also beneficial for moisturizing lips and helping remove dead skin cells. Meanwhile, *Aloe vera* extract acts as a moisturizer, preventing dry lips and protecting them from sun exposure. The combination of these two ingredients is expected to produce a natural lipstick with optimal coloring and moisturizing properties (Rizikiyan & Pandanwangi, 2019).

Extraction

The lipstick preparation in this study used dragon fruit peel extract and *Aloe vera* as natural ingredients. Extraction is the process of separating bioactive compounds using specific solvents, using methods that can be performed with or without heating. Heating can increase extraction efficiency but is less suitable for compounds that are not heat-resistant (Firdaus *et al*., 2024).

Dragon fruit peel contains betacyanin pigments, which have the potential to be used as natural dyes (Athaillah *et al*., 2023). Dragon fruit peel extraction was carried out using a maceration method using 96% ethanol for 24 hours at room temperature to maintain stable betacyanin content. The macerated filtrate was then evaporated without heating to prevent pigment degradation due to high temperatures (Firdaus *et al*., 2024; Sari, 2018).

Aloe vera was extracted using the infundation method using water as a solvent at 90°C for 15 minutes. This method was chosen due to its simple equipment and relatively low cost, although it has the potential to produce sediment if the solution is saturated (Triyana *et al*., 2022).

Excipients

The lipstick base plays a crucial role in determining the quality of the product because it affects texture, stability, and ease of application. The base used consists of cera alba, carnauba wax, and vaseline album. Cera alba provides a soft texture and moisturizing effect, while carnauba wax increases the lipstick's hardness and stability, preventing it from melting easily. The combination of the two also helps retain the antioxidants from dragon fruit extract on the surface of the lips (Warapsari *et al*., 2025).

In lipstick formulation, the difference in properties between the oil phase and the liquid extract can make the mixture difficult to homogenize, so cetyl alcohol is added as an emulsifier to stabilize the mixture and provide softness to the preparation (Vinaeni *et al*., 2022; Maheswara *et al*., 2025). To prevent microbial contamination, nipagin is used as a preservative, and BHT is added as a synthetic antioxidant to prevent damage from free radicals (Rahmah *et al*., 2023; Gultom & Ginting, 2018).

Natural dyes from dragon fruit extract are safer to use, but have limitations in color stability and consistency. Therefore, FD&C Red or Allura Red are added to make the lipstick color more stable and intense (Dwiki *et al*., 2018).

Procedure

The initial stage of lipstick production involves mixing red dragon fruit peel extract and aloe vera. Dragon fruit peel contains betacyanin pigments, which act as natural dyes and antioxidants, while *Aloe vera* acts as a moisturizer due to its lignin content, which can bind water to the lips (Athaillah *et al*., 2023). Previous research has shown that red dragon fruit peel extract and *Aloe vera* possess strong antioxidant activity, with IC50 values of 54.12 ppm and 74.25 ppm, respectively (Nurman *et al*., 2019; Rohiyati *et al*., 2020).

The next stage is melting the base consisting of cera alba, carnauba wax, cetyl alcohol, and vaseline album at a temperature of 80°C to ensure homogeneity of all ingredients. Cera alba serves as a hardener, carnauba wax increases stability and shine, cetyl alcohol as an emollient, and vaseline album as the main base (Dewi & Endriyanto, 2025; Anastasia & Desnita, 2023; Nadenka *et al*., 2025; Vuai *et al*., 2019). After melting, nipagin is added as a preservative and BHT as a synthetic antioxidant to prevent damage due to oxidation (Zain *et al*., 2022; Gultom & Ginting, 2018; Sapitri *et al*., 2025).

The extract mixture was added at a decreasing temperature to prevent degradation of the heat-sensitive betacyanin pigments (Illing & Hammado, 2021). Allura Red was added to increase the stability and intensity of the lipstick color (Dwiki *et al*., 2018). Next, the lipstick mass was molded and cooled to form a lipstick stick. This study used two formulas: a test formula containing plant extracts and a control formula without extracts to compare the physical properties of the preparations.

Organoleptic Test

Table 1.Organoleptic Test Results

Inspection	Preparation	
	F1	F2
Color	Bright red	White
Smell	The specific smell of aloe vera	Distinctive waxy smell
Form	Hard	Hard

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

This study conducted organoleptic tests, pH, homogeneity, spreadability, hardness, irritation, weight uniformity, melting point, and stability on lipstick preparations. The organoleptic test included visual observation of color, odor, and form of the preparation (Wati *et al*., 2024). The results showed that the first formula produced a bright red lipstick, a distinctive but not disturbing *Aloe vera* odor, and had a good shape. The second formula produced a white lipstick, a distinctive waxy odor, and had a suitable shape. The difference between the two formulas lies in the color and aroma influenced by the addition of dragon fruit extract, aloe vera, and FD&C Red dye to the first formula. Meanwhile, the second formula only showed the characteristics of a lipstick base such as vaseline album, carnauba wax, cera alba, and cetyl alcohol. Based on these results, both formulas met the organoleptic test requirements because they had a solid form, even color, and a distinctive aroma that was not rancid (Wargala *et al*., 2021).

pH test

Table 2. Results of pH examination of the preparation

Inspection	Preparation	
	F1	F2
pH	pH = 5	pH = 6

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

A pH test was conducted to determine the stability and acidity level of the lipstick preparation and to prevent irritation. A good lipstick pH is in the range of 4.5-6.5, which corresponds to the pH of the lips (Sari *et al*., 2025). The test was conducted using pH indicator paper on the preparation while it was still liquid before being printed. The results showed that both formulas met the lip pH requirements, with the first formula having a pH of 5 and the second formula having a pH of 6. The difference in pH values was influenced by the addition of red dragon fruit extract and aloe vera, where the higher the extract concentration, the more acidic the preparation tends to be (Lailatul *et al*., 2024; Safitri *et al*., 2022).

Homogeneity Test

Table 3. Results of Homogeneity Test

Inspection	Preparation	
	F1	F2
Homogeneity	Not homogeneous, the colors are not mixed evenly	Homogeneous

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

A homogeneity test is performed to ensure that the active ingredients and additives in the lipstick formulation are evenly mixed. The test is performed by applying the lipstick formulation to a transparent glass to check for component separation or coarse particles. A good formulation should exhibit a homogeneous composition without any coarse particles (Dwicahyani *et al*., 2019). Based on the observation results, both lipstick formulas showed homogeneous results because there was no component separation and no coarse particles were found in the formulation.

Smear Test

Table 4. Smear Test Results

Inspection	Preparation
	F1
Homogeneity	The spreadability is not good because the color does not stick

Information:

F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant

The spreadability test was conducted by applying the lipstick preparation to the back of the hand five times to determine the evenness and color adhesion (Keithler, 1956). A preparation with good spreadability is characterized by an even color adhesion. The results showed that the formula with dragon fruit and *Aloe vera* extracts felt slightly oily but soft, so it was able to moisturize dry skin. The formula without extracts was also slightly oily and could moisturize the skin, but did not provide a soft sensation. In the extract formula, the lipstick color did not last long because the betacyanin pigment is easily degraded by light, heat, and air, so the color faded more quickly than synthetic dyes (Kuncoro *et al*., 2022). Furthermore, the concentration of extracts in the lipstick base was not high enough to produce a long-lasting color stain.

Hardness Test

Table 5. Hardness Test Results

Inspection	Preparation	
	F1	F2
Violence	Qualify	Qualify

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

A hardness test was conducted to determine the durability and ability of lipstick to maintain its shape (Yuniarsih *et al*., 2023). The test was conducted by placing the lipstick horizontally and then applying a load of 300 grams and 350 grams for 30 seconds. The results showed that both formulas did not break after testing, thus meeting the lipstick hardness requirements. The formula with 18% dragon fruit extract and 3% *Aloe vera* had equivalent strength to the formula without extracts. This was influenced by the use of cera alba and vaseline album bases, which were able to increase the hardness and maintain the consistency of the lipstick preparation well (Rahmayanti *et al*., 2024).

Irritation Test

Table 6 Irritation Test Results

Inspection	The panelist	Preparation	
		F1	F2
Irritation	1	No irritation	No irritation
	2	No irritation	No irritation
	3	No irritation	No irritation
	4	No irritation	No irritation
	5	No irritation	No irritation

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant

F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

An irritation test is performed to determine any skin reactions after applying the lipstick. A positive irritation reaction is indicated by itching, swelling, or redness. A good lipstick does not cause irritation and is safe for use on the skin (Nurany *et al*., 2018). Based on panelist observations, both formulas showed no signs of irritation after several hours of application. Therefore, the lipsticks were declared safe for use.

Melting Point Test

Table 7 Melting Point Test Results

Inspection	Preparation	
	F1	F2
Melting point	55°C	55°C

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

Melting point testing was conducted to determine the stability of the lipstick formulation. A good lipstick has a melting point in the range of 50-70°C (Eryani *et al*., 2025). The results showed that both formulas met the requirements because they melted at 55°C. These results indicate that lipstick should be stored at room temperature, as temperatures above 55°C can cause the formulation to become unstable and easily damaged. Based on these results, the addition of dragon fruit and *Aloe vera* extracts to the first formula did not affect the lipstick's melting point (Lestari *et al*., 2021).

Weight Uniformity Test

Table 8 Results of Weight Uniformity Test

Inspection	Preparation of the	Preparation	
		F1	F2
Weight Uniformity	1	2.35 grams	2.28 grams
	2	2.39 grams	2.31 grams
	3	2.49 grams	2.37 grams
Average		2.41 grams	2.32 grams

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

A weight uniformity test was conducted to determine whether each lipstick preparation in each formula had the same weight (Sari *et al*., 2025). The results showed that both formulas did not meet the weight uniformity requirements because they had different average weights. The formula without extract had an average weight of 2.32 grams, while the formula with extract had an average weight of 2.41 grams. This difference is thought to be caused by the addition of extract to the first formula which increases the total mass of the preparation. The more additional ingredients used, the greater the final weight of the

resulting lipstick. Thus, the addition of extract affects the value of the weight uniformity of the lipstick preparation, where the formula with extract tends to have a greater weight than the formula without extract.

Cycling Stability Test

Table 9 Cycling Test Stability Results

Inspection	Preparation	
	F1	F2
Cycling Stability Test	No change in shape	No change in shape

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

A cycling stability test was conducted to determine the stability of lipstick against temperature changes (Dwicahyani *et al*., 2019). The test was conducted for three cycles at 4°C and 40°C, each for 24 hours. The results showed that both formulas did not experience changes in shape, color, or odor, thus meeting the requirements for lipstick stability (Nurwahidah *et al*., 2024). The addition of dragon fruit and *Aloe vera* extracts also did not affect the stability of the formulation.

Antioxidant Activity Test

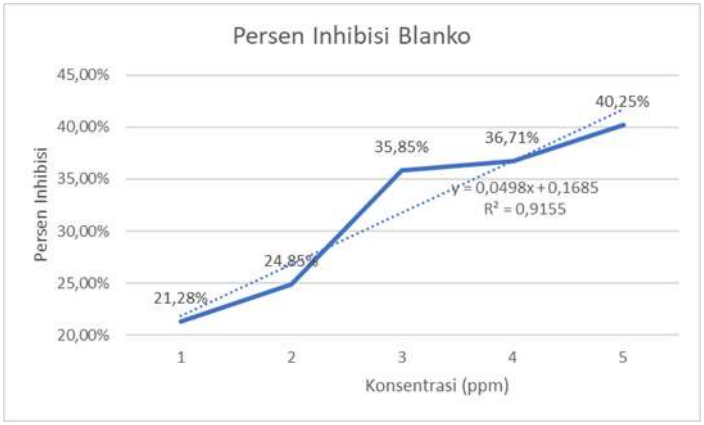

Figure 1 Blank inhibition percentage

Table 10 Antioxidant Activity Test Results

Inspection	Preparation	
	F1	F2
Antioxidant Activity Test	1.13 mMAAG/g	1.09 mMAAG/g

Information:
F1: Lipstick with dragon fruit peel extract, *Aloe vera* extract, and colorant
F2: Lipstick without dragon fruit peel extract, *Aloe vera* extract, and dyes

In general, to measure the parameters used to indicate antioxidant activity by using the coefficient concentration value or Efficient Concentration (EC50) or Inhibitory Concentration (IC50). To measure antioxidant power, one of them is by looking at the value that describes the concentration of the test extract

that has the potential to capture 50% of free radicals (IC50) by using a linear regression line equation that can describe the relationship between the average free radical scavenging activity (Y) and the concentration of the sample compound (X). Antioxidants can be calculated for their activity in capturing DPPH radicals. Further data analysis is calculated using a linear regression equation using the formula Y = a + bX where the final results obtained can be processed to obtain the IC50 value. DPPH compounds, in addition to providing advantages in terms of stability during storage where they are very stable and can be stored for a long period of time, DPPH compounds are also very easy to observe changes (Kemuning *et al*., 2023).

A standard curve is a curve that illustrates the relationship between absorbance and the concentration of a known standard solution. A standard curve is used to determine the concentration of an analyte in a sample. A standard curve is created from several standard solutions with concentrations that are within the linearity limit, allowing for linear regression based on the Lambert-Beer law, A = a bc (Fadhilah *et al*., 2022).

This calibration curve test was conducted with several variations in the concentration of standard vitamin C solutions with DPPH. The vitamin C concentrations used were 1, 2, 3, 4, and 5 ppm. Each standard solution was prepared from 100 ppm of vitamin C, which was then diluted using methanol to the specified concentration. Afterward, 2 ml of 50 ppm DPPH solution was added. The absorbance of these standard solutions was measured using a Vis spectrophotometer at its maximum wavelength of 517 nm.

Based on the results of standard solution measurements with various concentrations, the absorbance was 0.551; 0.526; 0.449; 0.443; 0.418. These results meet the requirements of the Lambert-Beer law, because according to Wulandari (2023), a good absorbance range is in the range of 0.2-0.8. In addition, the higher the standard concentration, the absorbance value decreases, the more electrons are donated by ascorbic acid to make DPPH free radicals more stable (Rozi *et al*., 2023).

In the linear equation y = with the correlation coefficient value (R) is 0.915. The correlation coefficient value obtained is the relationship between the concentration of the standard solution and its absorbance. According to Sayuthi & Kurniawati, (2017), a curve can be said to be linear if it meets the requirements > 0.9970. This result indicates that the calibration curve of the experimental results does not meet the requirements. This condition can be caused by several factors such as contamination by other substances, the lighting system, the presence of oxygen, and others.

Based on the test results, the IC50 value of the standard vitamin C solution was 6.651 ppm. The IC50 (Inhibitory Concentration 50%) value is a parameter used to indicate the concentration of a compound required to inhibit 50% of free radicals in a test system, such as the DPPH method. This value is obtained from the relationship between sample concentration and the percentage of inhibition, which is then created in the form of a curve to produce a regression equation to determine the IC50 point. The lower the IC50 value, the lower the concentration required to reduce free radicals, which means the compound's antioxidant activity is stronger (Rozi *et al*., 2023).

Based on the test results on the samples, the inhibition percentage of the extract formulation was 45% and the non-extract formulation was 44%, indicating a very small difference, so scientifically, it can be said that the difference is not significant. This difference can be explained by the presence of bioactive compounds in the extract, such as flavonoids and phenolics, which act as electron or hydrogen atom donors in scavenging DPPH free radicals. However, if the concentration of active compounds in the extract is relatively low or not significantly different from the non-extract formulation, the resulting increase in antioxidant activity will also be insignificant (Ambari *et al*., 2021).

Furthermore, antioxidant activity is significantly influenced by the concentration and stability of the compounds in the formulation. Research shows that increasing the concentration of extract in a preparation will increase antioxidant activity, but if the concentration used is not optimal, the difference in activity between formulations will be small (Ambari *et al*., 2021). A good inhibition percentage in the

DPPH method of antioxidant activity testing is generally a value approaching or exceeding 50%, as this value indicates that the sample is able to scavenge at least half of the free radicals in the test system (Hadirama *et al*., 2024).

The percent inhibition value is a direct indicator of an antioxidant's ability to reduce DPPH absorbance, so the higher the inhibition value, the stronger the antioxidant activity (Hadirama *et al*., 2024). The higher the percent inhibition at a concentration, the lower the IC50 value produced and the stronger the antioxidant activity. Therefore, an inhibition value of 44–45% can be categorized as moderate activity and not optimal, because it has not reached the ≥50% limit generally used as a reference for antioxidant effectiveness.

Based on the research results, the flavonoid content in the formulation containing dragon fruit peel extract was recorded at 1.13 mgQE/g, slightly higher than the control formulation (without extract) which was 1.09 mgQE/g. Theoretically, dragon fruit peel is rich in secondary metabolites such as flavonoids, phenolics, and betacyanins which function as natural antioxidants (Saenjum *et al*., 2021). Differences in total flavonoid values are also greatly influenced by the polarity of the solvent used. The use of 96% ethanol is considered the most effective solvent for extracting total phenolic and flavonoid content, so variations in this extraction process will directly impact the final measured levels (Pujiastuti, E., & El'Zeba, 2021).

One crucial factor suspected of influencing the results is the presence of BHT (Butylated Hydroxytoluene). As a synthetic antioxidant that works by scavenging free radicals, BHT has the potential to interact with test reagents or affect absorbance values in spectrophotometric measurements. This can lead to bias in the measured flavonoid values, especially if the testing method used is less selective (Nicolescu *et al*., 2025). Furthermore, the strong antioxidant activity of BHT can mask the contribution of active ingredients from the extract, resulting in very slight differences between the test and control formulations (Shraim *et al*., 2021).

Another equally important factor is the stability of flavonoid and betacyanin compounds, which are known to be easily degraded by light, temperature, and pH, thus reducing detectable levels (Kanagaraj *et al*., 2025). In addition to chemical factors, technical aspects of laboratory procedures also play a crucial role. Accuracy in standard curve preparation, dilution accuracy, and sample homogeneity are variables that can trigger variation in results.

CONCLUSION

This study shows that a natural lipstick formulation combining red dragon fruit (Hylocereus polyrhizus) peel extract and *Aloe vera* (*Aloe vera* L.) has potential as a decorative and functional cosmetic. The formula with the extract produces a bright red color, a pH within the physiological range of the lips, is homogeneous, stable in cycling tests, does not cause irritation, and has a higher antioxidant activity of 1.13 mgQE/g compared to the formula without the extract. The use of dragon fruit peel as a source of betacyanin has been proven to provide natural color and antioxidant activity, while *Aloe vera* provides a moisturizing effect on the lips. In addition, the combination of cera alba, carnauba wax, and vaseline album bases can produce lipstick with a hardness and melting point that meet the quality requirements of the preparation. Practically, this study provides implications that dragon fruit peel waste can be used as a natural cosmetic raw material that is safer, environmentally friendly, and has high economic value.

However, this study still has several limitations. The antioxidant activity of the extract and non-extract formulas showed relatively small differences, so the antioxidant effectiveness was not optimal. Furthermore, the DPPH calibration curve did not meet the required linearity, so the accuracy of the measurement results still needs to be improved. Color stability is also a challenge because betacyanin pigments are easily degraded by light, temperature, and oxygen, so the color adhesion on the lips is not

long-lasting. Therefore, further research is recommended to optimize the extract concentration, improve the antioxidant analysis method, and develop encapsulation technology or natural color stabilizers to increase pigment stability. Further research is also needed regarding long-term safety testing, consumer preference testing, and the development of formulations with other natural ingredients to obtain herbal lipstick products that are more effective, stable, and highly competitive in the cosmetics industry.

REFERENCES

Anastasia, DS, & Desnita, R. (2023). Review: Formulation and evaluation of lip gloss preparations. Medical Science: Pharmaceutical Scientific Journal, 8(2), 415–428.

Athaillah, Sundari, D., Pangondian, A., & Chandra, P. (2023). Formulation and evaluation of lipstick preparations from red dragon fruit extract (Hylocereus polyrhizus) and *Aloe vera* extract (Aloe vera) as natural colorants and moisturizers. Journal of Pharmaceutical and Sciences, 6(1), 60–70.

Chen, S.Y., Xu, CY, Mazhar, M.S., & Naiker, M. (2024). Nutritional value and therapeutic benefits of dragon fruit: A comprehensive review with implications for establishing Australian industry standards. Molecules, 29(23), 5676. https://doi.org/10.3390/molecules29235676

Choi, S., & Chung, M. H. (2023). A review on the relationship between *Aloe vera* components and their biological effects. Molecules, 28(3), 1234. https://doi.org/10.3390/molecules28031234

Dewi, SM, & Endriyatno, NC (2025). The effect of varying the concentration of cera alba as a stiffening agent in lip balm made from parijoto fruit extract (Medinilla speciosa Blume). PharmaCine: Journal of Pharmacy, Medical and Health Science, 6(2), 38–51.

Dwicahyani, U., Isrul, M., & Noviyanti, WON (2019). Formulation of lipstick preparation using ruruhi fruit peel extract (Syzygium polichephalum Merr.) as a colorant. Jurnal Mandala Pharmacon Indonesia, 5(2), 91–103.

Dwiki, Nur, Y., & Fadraersada, J. (2018). Stability profile of rosella flower extract (Hibiscus sabdariffa) as a lipstick colorant candidate. Proceeding of Mulawarman Pharmaceuticals Conferences, 8(1), 200–206.

Eryani, MC, Aditama, AP, Husni, P., & Permatasari, LP (2025). Formulation and physical evaluation of lipstick from beetroot (Beta vulgaris L.) peel extract. Jurnal Farmasi Galenika, 12(3), 173–181.

Fadhilah, R., Gatera, VA, Saula, LS, & Sakiran, S. (2022). Testing of formalin levels in tofu sold in Karawang Regency using the visible spectrophotometer method. Wahana Pendidikan Scientific Journal, 8(21), 357–369.

Firdaus, SM, Rosyidah, M., Permadi, A., Sulistiawati, E., & Wardhana, SB (2024). Optimization of maceration extraction process: Analysis of influential variables. In Proceedings of the National Seminar on Innovation and Technology. Ahmad Dahlan University.

Gultom, R., & Ginting, WM (2018). The effect of the antioxidant butyl hydroxy toluene (BHT) and vitamin E and heating time on the characterization and amount of omega-3 and omega-6 from soybean oil. JIFI (Imelda Pharmaceutical Scientific Journal), 1(2), 43–50.

Hadirama, *et al*. (2024). [Article title is incomplete in the manuscript].

Illing, I., & Hammado, N. (2021). Stability test of betacyanin compounds from kenop flower extract (Gomphrena globosa L.) as a natural food colorant. Cokroaminoto Journal of Chemical Science, 3(2), 1–7.

Kanagaraj, P., Bhatt, H., & Akbari, S. H. (2025). From waste to wealth: Bioactive compounds from dragon fruit peel and their applications. The Pharma Innovation, 14(8), 7–14.

Keithler, W.R. (1956). The formulation of cosmetics and cosmetic specialties. Drug and Cosmetic Industry.

Kemuning, GI, Wijianto, B., & Fahrurroji, A. (2022). Antioxidant test of methanol extract of onchidiid snails (Onchidium typhae) using the DPPH method. Indonesian Journal of Medical and Health Sciences, 2(3), 130–139.

Ministry of Health of the Republic of Indonesia. (2014). Indonesian Pharmacopoeia (Edition V). Ministry of Health of the Republic of Indonesia.

Ministry of Health of the Republic of Indonesia. (2017). Indonesian Herbal Pharmacopoeia (Second Edition). Ministry of Health of the Republic of Indonesia.

Ministry of Health of the Republic of Indonesia. (2020). Indonesian Pharmacopoeia (VIth Edition). Ministry of Health of the Republic of Indonesia.

Kuncoro, *et al*. (2022). [Article title is incomplete in the manuscript].

Lailatul, S., Yanti, EF, & Rosida. (2024). Formulation of red dragon fruit (Hylocereus polyrhizus) extract lip balm as a natural dye. Scientific Journal of Pharmacy, Academy of Pharmacy, 7(1), 1–11.

Lestari, U., Yusnelti, & Asra, R. (2021). Formulation of moisturizing lip lipstick based on tengkawang oil (Shorea sumatrana) with natural dye from jernang resin (Daemonorops didympophylla). Chempublish Journal, 6(1), 12–21.

Maheswara, RN, Rahmadani, N., & Mahreni. (2025). Optimization of Gelidium sp.-based body lotion formulation with variations in extraction water and cetyl alcohol. JUSTER: Journal of Science and Applied Sciences, 4(2), 33–42.

Martinez, R.M., Melo, CPB, Pinto, I.C., Mendes-Pierotti, S., Vignoli, J.A., Verri, W.A., & Casagrande, R. (2024). Betalains: A narrative review on pharmacological mechanisms supporting the nutraceutical potential towards health benefits. Foods, 13, 3909. https://doi.org/10.3390/foods13243909

Mawazi, SM, Azreen Redzal, NAB, Othman, N., & Alolayan, SO (2022). Lipsticks history, formulations, and production: A narrative review. Cosmetics, 9(1), 25.https://doi.org/10.3390/cosmetics9010025

Mulangsri, DAK, Murrukmihadi, M., & Muaniqoh, E. (2017). Physical characteristics of red dragon fruit (Hylocereus costaricensis) peel lipstick with variations in the concentration ratio of carnauba wax and beeswax. Journal of Chemical Engineering Innovation, 2(2).

Nadenka, N., Mulyanti, D., & Aryani, R. (2025). Lip cream formulation containing apricot kernel oil as a lip moisturizer. Bandung Conference Series: Pharmacy, 5(2), 1075–1084.

Nicolescu, A., Bunea, C.I., & Mocan, A. (2025). Total flavonoid content revised: An overview of past, present, and future determinations in phytochemical analysis. Analytical Biochemistry, 700, 115794. https://doi.org/10.1016/j.ab.2024.115794

Nurany, *et al*. (2018). [Article title is incomplete in the manuscript].

Nurman, *et al*. (2019). [Article title is incomplete in the manuscript].

Nurwahidah, AT, Wardhani, MK, Noviyanti, Shoaliha, M., & Puspitasari. (2024). Formulation and evaluation of lipstick preparations from red beetroot (Beta vulgaris L.) extract as a natural colorant in cosmetic lipstick preparations. Indonesian Journal of Pharmacy and Natural Product, 7(2), 198–216.

Pujiastuti, E., & El'Zeba, D. (2021). Comparison of total flavonoid levels of 70% and 96% ethanol extracts of red dragon fruit (Hylocereus polyrhizus) peel using spectrophotometry. Cendekia Journal of Pharmacy, 5(1), 28–43.

Rahmah, M., Anggraini, D., Novita, G., Furi, M., & Ihtiarudin, I. (2023). Formulation and sunscreen activity test of cream preparation of ethanol extract of marpuyan leaves (Rhodamnia cinerea Jack). Medical Science: Pharmaceutical Scientific Journal, 8(2), 723–732.

Rahmayanti, M., Haryadi, MC, Syarifuddin, S., Nastiti, GP, Anggraini, D., Hasanah, I., & Amiruddin, M. (2024). Development of lipstick formulation from a combination of teak leaf (Tectona grandis L.) and henna leaf (Lawsonia inermis L.) extracts as natural dyes. Jurnal Mandala Pharmacon Indonesia, 10(2), 411–418.

Ramadhina, NZ, Hendriyana, FZ, Dinata, PR, Yusuf, AN, Sahbrina, DP, Farohmah, NA, Lestari, T., Rahmasari, S., Putri, ME, & Sarah, KA (2025). Organic ingredients from *Aloe vera* as a natural lip moisturizer formulation. Jurnal Analis, 4(1), 81–92.

Regilia, D., Darmawan, E., & Laswati, DT (2024). Utilization of red dragon fruit (Hylocereus polyrhizus) as a natural dye and antioxidant source in steamed sponge cake. Agrotech: Scientific Journal of Agricultural Technology, 6(2), 19–26.

Rohiyati, MY, Juliantoni, Y., & Hakim, A. (2020). Formulation and antioxidant activity test of a peel-off mask preparation made from *Aloe vera* leaf extract (*Aloe vera* Linn.). Unram Medical Journal, 9(4), 317–322.

Rozi, F., Siddiq, MNAA, Majiding, CM, & others. (2023). Analysis of the antioxidant capacity of vitamin C-based beverages. Tambusai Health Journal, 4, 6105–6111.

Saenjum, C., Pattananandecha, T., & Nakagawa, K. (2021). Antioxidative and anti-inflammatory phytochemicals and related stable paramagnetic species in different parts of dragon fruit. Molecules, 26(12), 3565. https://doi.org/10.3390/molecules26123565

Safitri, Winarti, SA, Ikhtianingsih, W., & Yuniarsih, N. (2022). Optimization of *Aloe vera* (*Aloe vera* L.) extract lip balm as a lip moisturizer. Syntax Idea, 4(7), 1160–1165.

Sánchez, M., González-Burgos, E., Iglesias, I., & Gómez-Serranillos, M. P. (2022). Pharmacological update properties of *Aloe vera* and its major active constituents. Molecules, 27(4), 1324. https://doi.org/10.3390/molecules27041324

Sari, Y. (2018). The effect of heating on the stability of betalain pigments from red dragon fruit (Hylocereus polyrhizus). Orbital: Journal of Chemical Education, 2(1), 37–42.

Sari, DE, Muthoharoh, W., & Fitrianingsih, S. (2025). Formulation of lipstick preparation using Moringa oleifera L. seed oil as an emollient and turmeric (Curcuma longa L.) extract as a natural dye. Cendekia Journal of Pharmacy, 9(2), 151–163.

Sayuthi, MI, & Kurniawati, P. (2017). Validation of the analysis method and determination of paracetamol levels in tablet preparations using UV-visible spectrophotometry. In Proceedings of the National Chemistry Seminar, Faculty of Mathematics and Natural Sciences, UNESA (pp. 190–201).

Shraim, AM, Ahmed, TA, Rahman, MM, & Hijji, YM (2021). Determination of total flavonoid content by aluminum chloride assay: A critical evaluation. LWT, 150, 111932. https://doi.org/10.1016/j.lwt.2021.111932

Suharyani, I., Rindiyani, R., Senja, RY, Nurdianti, L., & Falya, Y. (2023). Application of red dragon fruit extract (Hylocereus polyrhizus) as an antioxidant in lip cream preparation. Indonesian Journal of Pharmaceutics, 5(1), 347–356.

Suteja, II, Wijanarka, W., & Kusdiyantini, E. (2022). Testing and identification of the antioxidant activity of LAB CIN-2 isolates from cincalok isolation. Journal of Science and Technology Research, 49–60.

Triyana, R., Putri, TA, Primawati, I., Susanti, M., Adelin, P., & Salmi. (2022). Effectiveness of star anise (Illicium verum) infusion larvicide on mortality of third instar Aedes aegypti larvae. Malahayati Nursing Journal, 4(11), 3130–3154.

Vinaeni, AR, Anindhita, MA, & Ermawati, N. (2022). Formulation of hand and body lotion from sambiloto leaf extract with cetyl alcohol as a stiffening agent. Cendekia Journal of Pharmacy, 6(1), 65–75.

Vuai, FRD, Desnita, R., & Anastasia, DS (2019). The effect of vaseline album concentration on the physical properties of almond oil (Prunus dulcis) lip gloss preparations. Journal of Pharmacy Students, Faculty of Medicine, UNTAN, 4(1).

Warapsari, NA, Hasriyani, & Sukojarjanti, BT (2025). The effect of a mixed base of beeswax and carnauba wax on the physical properties and SPF levels of mulberry (Morus alba L.) fruit extract lip balm formulations. Journal of Innovative and Creativity, 5(3), 25522–25538.

Wargala, E., Sławska, M., Zalewska, A., & Toporowska, M. (2021). Health effects of dyes, minerals, and vitamins used in cosmetics. Women, 1(4), 223–237. https://doi.org/10.3390/women1040018

Wati, H., Siswidiasari, A., & Sapto, T. (2024). Formulation and physical stability test of lipstick preparations from dry extracts of red dragon fruit peel (Hylocereus polyrhizus) and strawberry fruit (Fragaria ananassa) with a combination of paraffin wax and carnauba wax. Journal of Health Sciences, 3(1), 138–154.

Wulandari, ED (2024). Analysis of vitamin C levels in packaged beverages using the UV-Vis spectrophotometry method. Scientific Journal of Pharmacy Simplisia, 4(1), 35–42.

Yuniarsih, N., Putriana, A., Ariyanti, DK, Nurunnisa, I., Gilang, M., Setiawan, S., Putri, T., & Laelasari, T. (2023). Review article: Lipstick formulation using natural ingredients as natural dyes. Journal of Pharmaceutical and Sciences, 6(2), 831–837.

Zain, KR, Nugraha, MTA, & Purwaliyanti, ED (2022). Formulation and evaluation of ethanol extract balsam of red ginger rhizome (Zingiber officinale Roscoe) with the addition of nipagin as a preservative. Journal of Synthesis: Scientific Research, Application and Analysis, 3(2), 75–84.