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RESEARCH ARTICLE

The Art and Science of Lip Balm: Complete Preparation and Analytical Evaluation

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ABSTRACT

Lip balms are widely used cosmetic products designed to moisturize and protect the lips, yet there is growing consumer demand for formulations based on natural ingredients. This study addresses this gap by developing and evaluating a lip balm formulation utilizing beeswax, ghee, beetroot, and coconut oil-an innovative combination not widely reported in previous literature. The prepared lip balms were subjected to comprehensive physicochemical evaluations, including organoleptic assessment, pH measurement, melting point determination, spreadability testing, and stability studies. Results demonstrated that the formulations exhibited desirable organoleptic properties, a pH in the mildly acidic range (5.8–6.0), and a suitable melting point (63–65°C). Spreadability tests yielded good results, with a spread diameter of 32 mm at room temperature, indicating ease of application. Stability studies showed that the lip balms maintained their physicochemical characteristics for at least three months under various storage conditions. These findings highlight the feasibility and effectiveness of formulating stable, safe, and consumer-friendly lip care products using natural ingredients. This work contributes to the field of cosmetic science by providing a promising alternative to conventional synthetic lip balms and supports further innovation in herbal lip care formulations.

Keywords: lip balm, herbal formulation, beetroot, ghee, moisturizer, natural ingredients

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INTRODUCTION

Lip balms are topical formulations commonly applied to the lips to alleviate dryness, chapping and provide a protective barrier. These products typically consist of a blend of waxes, oils, and emollients that create a semi-solid consistency suitable for application to the delicate lip area.

The use of organic and natural ingredients in cosmetic products has gained significant attention due to growing concerns about the potential risks associated with synthetic excipients. Lips, lacking sebaceous glands, are particularly susceptible to dryness and require targeted moisturization and protection.

Conventional lip balms often contain a combination of occlusive agents, such as petrolatum and synthetic waxes, which form a protective film on the lip surface to prevent transepidermal water loss. However, these synthetic components may pose potential health risks and are less preferred by health-conscious consumers.

In contrast, organic lip balms aim to provide similar benefits using natural, plant-derived ingredients. These formulations may incorporate beeswax, carnauba wax, shea butter, and various vegetable oils, which possess inherent moisturizing, emollient, and protective properties. The use of natural fragrances and the exclusion of parabens, alumina, and artificial colors further enhance the safety and acceptability of organic lip balms.

The primary function of lip balms, regardless of their composition, is to create a protective barrier on the lips, sealing in moisture and shielding them from external factors such as wind, cold, and sun exposure. This barrier helps maintain the lips' hydration and prevents further drying, cracking, and irritation.

Lip balms are essential cosmetic products designed to alleviate dry, chapped lips by providing a protective and moisturizing layer. The growing preference for organic and natural ingredients in cosmetics has led to the development of alternative lip balm formulations that cater to health-conscious consumers while still effectively addressing the unique needs of the delicate lip area.

Trends in Lip Balm Formulation

Recent years have seen a growing preference for organic and natural ingredients in cosmetic products, largely due to concerns about the potential risks associated with synthetic excipients. Since lips lack sebaceous glands, they are particularly susceptible to dryness and require targeted moisturization and protection.

Conventional lip balms often contain occlusive agents such as petrolatum and synthetic waxes, which form a film on the lip surface to prevent transepidermal water loss. However, some studies have raised concerns regarding the long-term safety of certain synthetic components, prompting health-conscious consumers to seek alternatives.

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In response, organic lip balms have been developed using plant-derived ingredients such as beeswax, carnauba wax, shea butter, and various vegetable oils. These components offer inherent moisturizing, emollient, and protective properties. Organic formulations often exclude parabens, alumina, and artificial colors, further enhancing their appeal and safety profile.

Functions and Benefits

The primary function of any lip balm is to create a protective barrier on the lips, sealing in moisture and shielding them from wind, cold, and sun exposure. This barrier helps maintain hydration and prevents further drying, cracking, and irritation. The shift toward organic formulations addresses consumer demand for safer, more natural products without compromising efficacy.

Advantages of Lip Balm

Moisturize Your Lips

Lip balms provide essential hydration to prevent dryness and chapping.

Protection Against Harsh UV Rays

Some lip balms offer UV protection to shield lips from sun damage.

Smooth Lipstick Application

Lip balms create a smooth base for lipstick application.

Hint of Colour

Tinted lip balms add a subtle tint while moisturizing the lips.

Glossy Look

Lip balms can impart a glossy finish for a polished appearance.

Brighten Lips

Certain lip balms help enhance the natural color of the lips.

Table 1: Advantages of Lip Balm

Benefit	*Description*
Moisturization	Prevents dryness and chapping by providing essential hydration
UV Protection	Some formulations offer SPF to shield lips from sun damage.
Smoother Lipstick Application	Creates a smooth base for lipstick
Subtle Tint	Tinted balms add color while moisturizing.
Glossy Finish	Imparts a polished, glossy appearance
Brightening	Certain balms enhance the lips' natural color.
Intensive Care	Acts as a lip mask for deep hydration and nourishment

Combat Dryness

Lip balms effectively combat dry, flaky lips.

Lip Mask

Acting as a lip mask, lip balms provide intensive hydration and nourishment. A summary of these advantages is mentioned in Table 1.

Market Overview

According to a recent market research report, the global lip balm market was valued at USD 784.2 million in 2021, with a projected compound annual growth rate (CAGR) of 6.3% through the forecast period. This growth is driven by increasing consumer awareness of lip care and the rising demand for natural and organic products. *(Grand View Research, 2022.)*

Types of Lip Balms

Tinted Lip Balm

Combines moisturization with subtle lip color, offering a luminous finish.

Medicated Lip Balm

This is often prescribed by dermatologists for chapped lips to address specific lip conditions.

Flavoured Lip Balm

Infused with flavors like vanilla, mint, or fruity essences for a pleasant application experience.

Organic Lip Balm

Formulated with natural ingredients like avocado oil, beeswax, and vitamin E, avoiding harmful chemicals.

SPF Lip Balm

Contains sun protection factors to shield lips from harmful UV rays and prevent sun damage.

Plumping Lip Balm

Enhances lip fullness while providing hydration and protection.

CBD or Hemp Oil Lip Balm

Incorporates CBD or hemp oil for anti-inflammatory benefits and excellent moisturization.

Each type of lip balm caters to specific needs, from hydration and protection to color enhancement and specialized benefits, offering consumers a wide array of choices to suit their preferences and lip care requirements, as listed in Table 2.

Material Use

Common ingredients, along with their sources and functions, are also listed in Table 3.

Table 2: Types of Lip Balms

Type	*Key Ingredients*	*Primary Function*	*Target Consumer*
Tinted Lip Balm	Plant oils, waxes, natural pigments	Moisturization + color	Those seeking a subtle tint
Medicated Lip Balm	Menthol, camphor, healing agents	Treat chapped/damaged lips	Individuals with lip conditions
Flavored Lip Balm	Essential oils, natural flavors	Pleasant application	Youth, general consumers
Organic Lip Balm	Beeswax, shea butter, plant oils	Natural care, no chemicals	Health-conscious consumers
SPF Lip Balm	Zinc oxide, titanium dioxide, SPF agents	Sun protection	Outdoor enthusiasts
Plumping Lip Balm	Hyaluronic acid, peptides	Enhances fullness, hydration	Beauty-focused consumers
CBD/Hemp Oil Lip Balm	CBD oil, hemp seed oil	Anti-inflammatory, soothing	Wellness consumers

Table 3: Common Ingredients and Their Sources

Ingredient	*Source/Description*	***Function(s)***
Beeswax	Natural wax secreted by bees	Moisturizes, forms a protective layer
Glycerol	Plant-derived humectant	Retains moisture, glossy finish
Beetroot	Antioxidant-rich root vegetable	Natural coloring, antioxidant
Almond Oil	Oil extracted from almond seeds	Deep moisturizer soothes lips
Aloe Vera	Gel from Aloe vera leaves	Anti-inflammatory, antioxidant
Vitamin E	Fat-soluble antioxidant	Softens, reduces aging signs
Rose Water	Distilled from rose petals	Soothes, adds aroma
Ghee	Clarified butter	Hydrates, locks in moisture
Strawberry	Extracts rich in Vitamin C and antioxidants	Hydrates, lightens lips

Beeswax

Beeswax, a natural compound secreted by female bees, is known for its moisturizing properties, sun protection benefits, pleasant aroma, and ability to impart glossiness and hardness to lip balms.

Glycerol

Glycerol, a natural humectant, effectively absorbs and retains moisture, sealing cracks and flakiness on the lips, resulting in soft, plump lips. It also provides a glossy effect.

Beetroot

Beetroot juice, rich in antioxidants, is used as a natural coloring agent in lip balms, offering additional skin benefits.

Almond Oil

Extracted from almond seeds, almond oil deeply moisturizes the lips, reduces redness, and soothes chapped or sunburnt lips due to its anti-inflammatory properties.

Aloe Vera

Aloe vera gel, obtained from the leaves of the plant, has anti-inflammatory properties that combat irritation, provide antioxidants to fight skin damage, and promote healthy, wrinkle-free lips.

Vitamin E

Vitamin E, an antioxidant and natural conditioner, helps maintain lip softness, and youthfulness, and reduces signs of aging.

Rose Water

Rose water, a 2% solution made from rose powder, adds a soothing and aromatic element to lip balms.

Ghee

Ghee, a hydrating ingredient, locks in moisture, making it an excellent natural lip balm for daily use.

Strawberry

Strawberry extracts, rich in Vitamin C and antioxidants, hydrate the lips and help reduce lip darkness.

Method of Preparation

The preparation of the herbal lip balm stick was carried out using a standardized, reproducible process to ensure product quality and consistency. Each ingredient was carefully selected and processed to maintain its functional properties as mentioned in Table 4 and a flow chart is also shown in Figure 1, which indicates different steps of preparation of herbal lip balm.

Ingredient Selection and Preparation

- *Beeswax*

Used in solid, purified form.

- *Beetroot*

Fresh beetroot was washed, peeled, and juiced using a cold-press juicer. The juice was filtered through a fine muslin cloth to remove particulates.

- *Strawberry Pulp*

Fresh strawberries were washed, hulled, and blended into a fine pulp. The pulp was filtered to remove seeds and coarse particles.

- *Aloe Vera*

Fresh aloe vera leaves were cleaned, and the inner gel was extracted and homogenized.

- *Rose Water*

Prepared as a 2% solution using rose powder and distilled water, then filtered.

- *Other Ingredients*

Almond oil (cold-pressed), Vitamin E (oil-based), ghee (clarified butter), and glycerol (pharmaceutical grade) were used as received.

Weighing of Ingredients

All ingredients were accurately weighed using a digital analytical balance (±0.1 g accuracy) to ensure precise formulation.

Melting and Heating

Melting

Beeswax and ghee were combined in a glass beaker and melted in a water bath at 70°C ± 2°C for 10 minutes until a clear, homogenous liquid was obtained.

Heat-Sensitive Additions

Strawberry pulp, beetroot juice, aloe vera gel, almond oil, glycerol, rose water, and Vitamin E were pre-mixed in a separate beaker at room temperature to prevent degradation of heat-sensitive compounds.

Mixing and Homogenization

- The melted beeswax-ghee mixture was gradually added to the pre-mixed liquid ingredients with continuous stirring.

Mixing Method

A magnetic stirrer was used at 500 rpm for 10 minutes to ensure uniform dispersion.

Homogenization

The mixture was further homogenized using a high-speed homogenizer at 10,000 rpm for 3 minutes to achieve a smooth, uniform consistency.

Molding

- The homogenous mixture was immediately poured into pre-sterilized lip balm stick molds.
- Care was taken to avoid air bubble formation during pouring.

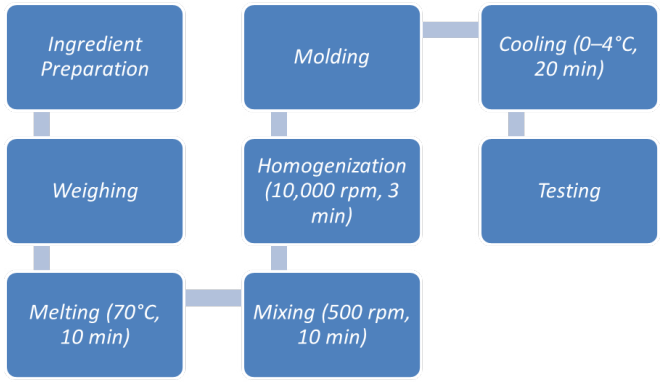

Figure 1: Flow Diagram of Herbal Lip Balm Preparation

Table 4: Formula for Herbal Lip Balm

Sr. No.	*Ingredient*	*Percentage (%)*	*Function*
1	Beeswax	22	Imparts glossiness and hardness
2	Beetroot Juice	15	Antioxidants, natural coloring
3	Almond Oil	10	Moisturizes, anti-inflammatory properties
4	Aloe Vera Gel	10	Soothes irritation, provides antioxidants
5	Vitamin E	3	Natural conditioner reduces aging signs
6	Rose Water	3	Soothing, aromatic
7	Glycerol	15	Humectant retains moisture
8	Ghee	7	Hydrating locks in moisture
9	Strawberry Pulp	15	Hydrating helps reduce lip darkness
	Total	100	

Cooling and Solidification

- The filled molds were placed in an ice bath (0–4°C) for 20 minutes to facilitate rapid solidification and enhance product stability.

Final Testing

- After solidification, the lip balm sticks were removed from the molds and subjected to stability and analytical testing (e.g., texture, uniformity, pH, and microbial load) to ensure quality.

Evaluation of Lip Balm

A comprehensive evaluation of the formulated herbal lip balm was conducted to assess its physical, sensory, functional, and stability properties. The following standardized tests and quantifiable metrics were employed:

Melting Point

The melting point of the lip balm was determined using the capillary method. A glass capillary sealed at one end was filled with the lip balm sample and immersed in liquid paraffin within a calibrated melting point apparatus equipped with magnetic stirring. The temperature at which the sample completely melted was visually observed and recorded.

Organoleptic Properties

The lip balm was evaluated for key organoleptic characteristics, including:

Color

Assessed visually under natural daylight.

Odor

Evaluated by direct smelling.

Taste

Assessed by a volunteer panel (when applicable and safe).

Appearance

Examined for texture, smoothness, and homogeneity.

These sensory attributes provide insights into the product's consumer appeal and quality.

Spreadability Test

Spreadability was quantitatively evaluated by placing 0.5 g of lip balm between two glass slides and applying a 500 g weight for 1 minute at room temperature (25°C), refrigeration (4°C), and elevated temperature (40°C). The spread diameter (in millimeters) was measured using a ruler or digital caliper.

Interpretation

- *Good (G)*

Spread diameter ≥ 30 mm, uniform film, no fragmentation or deformation.

- *Intermediate (I)*

Spread diameter 20–29 mm, minor fragmentation or deformation.

- *Bad (B)*

Spread diameter < 20 mm, significant fragmentation, uneven application, or severe deformation.

pH Measurement

The pH of the lip balm was measured by dispersing 1 g of the sample in 100 ml of distilled water and using a calibrated digital pH meter. This test provides information about the acidity or alkalinity of the formulation, which is important for lip health.

Skin Irritation Test

To assess dermatological safety, a small amount of lip balm was applied to the inner forearm of at least 10 healthy volunteers (n=10). The application site was observed after 24 hours for any signs of irritation, such as redness, swelling, or itching. This sample size provides more reliable preliminary safety data than a single-subject test.

Breaking Point (Hardness)

The breaking point was determined using a texture analyzer, which measures the force (in grams) required to break the lip balm stick. This test assesses the product's structural integrity and suitability for use as a stick.

Stability Studies

Accelerated stability testing was performed by storing lip balm samples under the following conditions:

- Room temperature (25.0 ± 3.0°C)
- Refrigeration (4.0 ± 2.0°C)
- Oven temperature (40.0 ± 2.0°C)

After 1, 2, and 3 months, the samples were reevaluated for organoleptic properties, melting point, spreadability, pH, and breaking point to assess their stability and performance over time.

By employing these comprehensive and quantifiable evaluation methods-including physical, sensory, chemical, and dermatological assessments thorough understanding of the lip balm's quality, performance, and stability was achieved, ensuring a reliable and effective product for consumers.

Table 5: Stability Results of Lip Balm Over 3 Months

Sr. No.	*Evaluation Parameter*	*Initial Value*	*After 1 Month*	*After 2 Months*	*After 3 Months*
1	Melting Point (°C)	63–65	63–64	62–64	61–64
2.1	Color	White	White	White	White
2.2	Odor	Pleasant	Pleasant	Pleasant	Pleasant
2.3	Appearance	Smooth	Smooth	Smooth	Smooth
3	Spreadability (mm, 25°C)	32	32	31	30
4	pH	6.0	6.0	5.9	5.8
5	Skin Irritation (n=10)	No	No	No	No
6	Breaking Point (g)	29	29	28	28

Table 6: Stability Results of Lip Balm Under Different Temperature Conditions (Initial Values)

Parameter	*25.0 ± 3.0°C*	*4.0 ± 2.0°C*	*40.0 ± 2.0°C*
Colour	White	White	White
Odour	Pleasant	Pleasant	Pleasant
Melting Point(°C)	63	65	64
Spreadability(mm)	32	30	22
pH	6.0	6.0	6.2

RESULTS

All parameters were evaluated at baseline and after 1, 2, and 3 months of storage under various conditions. Comprised data of the result and image of the formulation are in Tables 5 and 6 and Figure 2.

Melting Point

The melting point of the lip balm formulation, determined using the capillary method, ranged from 63°C to 65°C initially. This consistent melting behavior was maintained throughout the 3-month study, indicating good thermal stability.

Organoleptic Properties

Color

The lip balm exhibited a uniform white color at all time points.

Odor

A pleasant, non-offensive aroma was consistently observed, likely due to the use of natural ingredients and the absence of synthetic fragrances.

Appearance

The product maintained a smooth, homogeneous texture without visible irregularities or impurities.

Spreadability

Spreadability was quantitatively assessed by measuring the spread diameter (in mm) of 0.5 g of lip balm compressed between two glass slides under a 500 g weight for 1 minute at room temperature (25°C).

Figure 2: Image of Formulated Lip Balm

- Initial spread diameter: 32 mm (Good)
- After 3 months: 30 mm (Good)
- At 4°C: 30 mm (Good)
- At 40°C: 22 mm (Intermediate)

pH Measurement

The pH of the lip balm, measured by dispersing 1 g in 100 ml distilled water, was 6.0 initially and ranged from 5.8 to 6.0 over 3 months, indicating a mildly acidic and lip-friendly formulation.

Skin Irritation

The skin irritation potential was evaluated on 10 healthy volunteers (n=10) by applying a small amount of lip balm to the inner forearm. No visible signs of irritation (redness, swelling, or itching) were observed in any subject after 24 hours, suggesting good dermatological safety for use on the lips.

Breaking Point

The breaking point (hardness) was measured using a texture analyzer. The force required to break the lip balm stick was 29 grams initially, with a minimal decrease to 28 grams after 3 months, indicating good structural integrity.

CONCLUSION

A comprehensive evaluation of the natural ingredient-based lip balm formulation demonstrated that the product maintained excellent stability and functionality when stored at room temperature and under refrigeration. Throughout the three-month study, organoleptic properties such as color, odor, and texture remained unchanged, and spreadability consistently achieved favorable results, indicating the formulation's robustness under standard storage conditions. The lip balm exhibited an appropriate melting point, with a mean value of 64°C, and quantitative spreadability testing confirmed its ease of application and suitability for consumer use.

However, storage at elevated temperatures (40.0 ± 2.0°C) resulted in a decline in product performance, emphasizing the importance of proper storage to preserve quality and efficacy. Safety assessments, including skin irritation testing on a panel of volunteers, indicated that the formulation is well-tolerated and safe for application on the lips. The use of natural excipients in the formulation not only contributed to its safety profile but also highlighted the potential for developing new and improved lip care products through the exploration of alternative or combined excipient systems.

Overall, the study confirms that the evaluated lip balm formulation is stable, safe, and effective for lip care applications. The findings support further research into innovative ingredient combinations to enhance product characteristics and meet evolving consumer preferences in the lip care market.

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