

Formulation and Evaluation of A Herbal Lip Balm Using Natural Oils and Beetroot Extract

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Abstract

The growing consumer preference for natural and chemical-free cosmetic products has accelerated the development of herbal formulations in personal care. The present study aimed to formulate and evaluate a herbal lip balm using natural ingredients as a safe and effective alternative to synthetic lip care products. Cocoa butter was used as the base material, while coconut oil, olive oil, and glycerine were incorporated as emollients and humectants. Vitamin E was added as an antioxidant, and beetroot extract was utilised as a natural colouring agent. Five different formulations were prepared by varying the oil composition. The formulated lip balms were evaluated for organoleptic properties, melting point, pH, spreadability, stability, and skin irritation. All formulations exhibited a smooth texture, uniform dark pink colour, and pleasant odour. The melting points ranged between 60–70 °C, indicating appropriate consistency and thermal stability. The pH values were close to neutral, suggesting good compatibility with lip skin. Stability studies conducted for 30 days under different storage conditions revealed no significant changes in physicochemical properties. Skin irritation tests confirmed the safety of the formulations for topical application. The findings demonstrate that herbal lip balm prepared using natural ingredients provides effective moisturisation, stability, and safety, supporting its potential as an eco-friendly and skin-compatible alternative to conventional synthetic lip balms.

Keywords: Herbal cosmetics; Lip balm; Beetroot extract; Cocoa butter; Natural oils; Stability evaluation

INTRODUCTION

Cosmetic products are widely used for personal care and aesthetic enhancement; however, the increasing incorporation of synthetic chemicals such as artificial colourants, preservatives, and fragrances has raised concerns regarding skin irritation, toxicity, and long-term adverse effects on human health. Conventional cosmetic formulations often contain substances that may cause dryness, pigmentation, allergic reactions, and environmental harm with prolonged use. As a result, there has been a growing shift toward herbal cosmetics, which are formulated using natural ingredients and are considered safer, biocompatible, and environmentally friendly (Kapoor, 2022; Gediya et al., 2021). Herbal cosmetics utilise plant-based materials possessing inherent pharmacological properties such as antioxidant, antimicrobial, and anti-inflammatory effects, making them suitable for long-term use with minimal side effects (Pandey et al., 2022).

Lips are among the most sensitive parts of the human body due to their unique anatomical structure. The lip epithelium is thinner than facial skin and lacks sweat glands, sebaceous glands, and sufficient melanin, which makes the lips highly susceptible to dryness, cracking, inflammation, and damage caused by environmental factors such as ultraviolet radiation, cold weather, and pollution (Harry and Wilkinson, 2020). Consequently, regular protection and moisturisation are essential to maintain lip health and prevent discomfort.

Lip balms are topical preparations designed to protect the lips by forming an occlusive barrier that reduces transepidermal moisture loss while providing emollient and healing effects. Herbal lip balms formulated with natural oils, waxes, and plant extracts offer effective moisturisation, nourishment, and protection without the harmful effects associated with synthetic additives (Balsam and Sagarin, 2021). Natural ingredients such as cocoa butter, coconut oil, olive oil, glycerine, and vitamin E are widely recognised

for their emollient, antioxidant, and skin-conditioning properties (Denavarre, 2020). Additionally, beetroot extract, rich in natural pigments and antioxidants, serves as an effective herbal colouring agent while contributing protective and nourishing benefits to lip care formulations (Fernandes et al., 2016).

The present study focuses on the formulation and evaluation of a herbal lip balm using natural ingredients to develop a safe, stable, and effective alternative to synthetic lip care products.

MATERIALS AND METHODS

Materials

The herbal lip balm was formulated using naturally derived ingredients selected for their functional and cosmetic properties. Cocoa butter was used as the base due to its film-forming ability, stability, and emollient nature. Coconut oil and olive oil were incorporated as moisturising agents, while glycerine was included as a humectant to retain moisture and prevent dryness of the lips. Vitamin E capsules were added as an antioxidant to enhance formulation stability and provide protective benefits against oxidative damage. Beetroot extract was utilised as a natural colouring agent owing to its betalain pigments and antioxidant potential, which have been widely reported in cosmetic and pharmaceutical applications (Ali et al., 2020). Rose water and essential oils were added in small quantities to improve fragrance and soothing properties. All materials used were

of pharmaceutical grade and suitable for cosmetic formulations.

Preparation of Beetroot Extract

Fresh beetroot was washed thoroughly to remove adhering dirt and impurities and then peeled to eliminate the outer skin. The peeled beetroot was grated uniformly and spread in a thin layer on parchment paper. Drying was carried out in a hot air oven maintained at 70–80 °C to remove moisture while minimising degradation of heat-sensitive constituents. The dried material was cooled to room temperature and ground into a fine powder.

For extraction, 1–2 g of beetroot powder was mixed with 8–10 ml of distilled water and heated gently until boiling with continuous stirring. The mixture was filtered through muslin cloth to obtain a clear aqueous extract, which was used as a natural colouring agent. The use of beetroot extract as a natural pigment in cosmetic formulations has been previously reported due to its safety and colouring efficiency (Fernandes et al., 2016).

Formulation of Herbal Lip Balm

Five different herbal lip balm formulations were prepared using varying combinations of natural oils, while cocoa butter was maintained as the base ingredient. Accurately weighed cocoa butter was melted using a water bath to ensure controlled heating. Once partially melted, coconut oil, olive oil, or glycerine was added depending on the formulation, and the mixture was stirred continuously until a homogenous blend was obtained.

Table 1: Composition of Herbal Lip Balm Formulations

Ingredient	F1 (Coconut Oil)	F2 (Vitamin E)	F3 (Cocoa Butter)	F4 (Olive Oil)	F5 (Glycerine)
Cocoa butter (g)	1.5	1.5	1.5	1.5	1.5
Coconut oil (ml)	1.5	1.5	1.5	—	1.5
Olive oil (ml)	—	—	—	4.0	—
Glycerine (ml)	—	—	—	—	4.0
Vitamin E (ml)	0.5	0.5	0.5	0.5	0.5
Beetroot extract	q.s.	q.s.	q.s.	q.s.	q.s.

F = Formulation; *q.s.* = quantity sufficient

Table 2: Functional Role of Ingredients Used

Ingredient	Functional Role
Cocoa butter	Base material, emollient, structural stability
Coconut oil	Moisturiser, emollient
Olive oil	Skin conditioning, hydration
Glycerine	Humectant, moisture retention
Vitamin E	Antioxidant, formulation stability
Beetroot extract	Natural colouring agent, antioxidant
Rose water	Fragrance, soothing agent

Vitamin E oil was then incorporated as an antioxidant, followed by the addition of beetroot extract for colour. Rose water and essential oils were added to enhance sensory characteristics. The molten mixture was poured into clean containers and allowed to cool and solidify at room temperature. The prepared formulations were stored in airtight containers for further evaluation.

Evaluation Parameters

Organoleptic Properties

The prepared lip balm formulations were evaluated for colour, odour, and appearance by visual inspection to assess uniformity and consumer acceptability.

Melting Point

The melting point of each formulation was determined using the capillary method. The melting temperature was recorded visually and used as an indicator of formulation stability and suitability for storage under varying environmental conditions, as melting point is a critical quality parameter for lip care products (Balsam and Sagarin, 2021).

pH Determination

The pH of the lip balm formulations was measured using a digital pH meter to ensure compatibility with lip skin. Maintaining pH close

to neutral is essential to minimise irritation and discomfort during application (Harry and Wilkinson, 2020).

Spreadability

Spreadability was assessed using the glass slide method by repeatedly applying the lip balm and observing uniformity, smoothness, and ease of application. Spreadability is a key determinant of user acceptability and performance of topical cosmetic products.

Stability Studies

Accelerated stability studies were conducted by storing the formulations at room temperature ($25 \pm 3^\circ\text{C}$), refrigeration conditions ($4 \pm 2^\circ\text{C}$), and oven temperature ($40 \pm 2^\circ\text{C}$) for 30 days. The formulations were periodically evaluated for changes in colour, odour, melting point, pH, spreadability, and physical appearance, following standard cosmetic stability evaluation practices (Denavarre, 2020).

Skin Irritation Test

Skin irritation studies were performed on healthy human volunteers by applying a small quantity of lip balm to a 2 cm^2 area on the inner surface of the upper arm. The application site was observed for signs of redness, itching, swelling, or irritation to assess product safety.

Table 3: Evaluation Parameters for Herbal Lip Balm

Parameter	Method Used	Purpose
Organoleptic properties	Visual inspection	Appearance and acceptability
Melting point	Capillary method	Thermal stability
pH	Digital pH meter	Skin compatibility
Spreadability	Glass slide method	Ease of application
Stability study	30 days at different temperatures	Shelf-life assessment
Skin irritation test	Human volunteers	Safety evaluation

RESULTS

All five herbal lip balm formulations exhibited a uniform dark pink colour imparted by beetroot extract, along with a smooth texture and pleasant odour. The melting points of the formulations ranged between 60 °C and 70 °C, indicating suitable hardness and stability for lip balm applications.

The pH values of the formulations were found to be close to neutral, suggesting good compatibility with lip skin and a low risk of irritation. Spreadability evaluation demonstrated

uniform application and formation of a smooth protective layer without fragmentation.

Stability studies conducted for 30 days showed no significant changes in colour, odour, pH, melting point, or texture at room temperature and refrigerated conditions. Minor textural variations were observed at elevated temperature but did not compromise overall formulation performance. Skin irritation studies confirmed the absence of adverse reactions, indicating that the formulations were safe for topical use.

Table 4: Organoleptic Characteristics of Lip Balm Formulations

Formulation	Colour	Texture	Odour
F1	Dark pink	Smooth	Pleasant
F2	Dark pink	Smooth	Pleasant
F3	Dark pink	Smooth	Pleasant
F4	Dark pink	Smooth	Pleasant
F5	Dark pink	Smooth	Pleasant

Table 5: Stability Study Results (30 Days)

Parameter	Room Temp (25 ± 3 °C)	Refrigeration (4 ± 2 °C)	Oven (40 ± 2 °C)
Colour	No change	No change	No change
Odour	Pleasant	Pleasant	Pleasant
Melting point	60–70 °C	60–70 °C	Slight variation
pH	~7.0	~7.0	~7.0
Spreadability	Good	Good	Intermediate
Skin irritation	None	None	None

DISCUSSION

The findings of this study indicate that the choice and proportion of natural ingredients play a crucial role in determining the physicochemical properties and stability of herbal lip balm formulations. Cocoa butter provided structural integrity and appropriate melting behaviour, ensuring ease of application and resistance to deformation. Coconut oil and olive oil enhanced moisturising and emollient properties, contributing to improved lip softness and hydration, which is consistent with their documented cosmetic benefits (Kapoor, 2022).

Glycerine acted effectively as a humectant, helping to retain moisture and prevent dryness. Vitamin E enhanced formulation stability by protecting against oxidative degradation while also contributing to lip nourishment. Beetroot extract proved to be an effective natural colouring agent, imparting an appealing colour without compromising stability or safety.

The favourable outcomes of stability and skin irritation studies highlight the compatibility of herbal ingredients and support their suitability for cosmetic applications. These results align with previous reports emphasising the safety and efficacy of herbal cosmetics compared to synthetic alternatives (Gediya et al., 2021; Pandey et al., 2022).

CONCLUSION

The present study successfully formulated and evaluated a herbal lip balm using natural ingredients and beetroot extract. The developed formulations exhibited acceptable physicochemical characteristics, good stability, satisfactory spreadability, and absence of skin irritation. The findings demonstrate that herbal lip balms can provide effective moisturisation and protection while minimising the risks associated with synthetic additives.

The use of plant-based ingredients aligns with increasing consumer demand for eco-friendly,

safe, and sustainable cosmetic products. Therefore, herbal lip balm formulations prepared using natural oils and extracts represent a promising alternative to conventional lip care products and offer potential for further development and commercial application.

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