International Journal of Science and Research Methodology (IJSRM)
Volume 29, Issue 4, April 2026 ijsrm.humanjournals.com ISSN: 2454-2008

Formulation and Evaluation of Herbal Lip Serum with SPF Activity

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Received: 21 February 2026 Revised: 10 March 2026 Accepted: 25 March 2026

ABSTRACT

Herbal-based lip care formulations have gained significant prominence owing to their superior safety, enhanced biocompatibility, and diverse functional attributes. The present investigation is aimed at the formulation and systematic evaluation of herbal lip serum incorporated with Sun Protection Factor (SPF) activity. The developed formulation is intended to deliver adequate hydration, nourishment, and photoprotection against harmful ultraviolet (UV) radiation. The lip serum was formulated using naturally derived components such as coconut oil, almond oil, beeswax, shea butter, peppermint oil, vitamin E, Aloevera gel, Beetroot extract and zinc oxide, which are well known for their emollient, antioxidant, soothing, and UV-protective properties. Multiple formulations were prepared and subjected to evaluation based on physicochemical and biological parameters including pH, spreadability, homogeneity, irritancy, and SPF value. The optimized formulation exhibited satisfactory stability, a physiologically acceptable pH range, desirable consistency, and significant photoprotective efficacy, thereby demonstrating its potential as an effective and safe herbal lip care product.A lip serum with SPF is a concentrated formulation designed to offer protection against solar radiation while providing hydration, lip enhancement, and healing benefits upon application. Additionally, it imparts a subtle pink tint to the lips. Compared to lip oils, lip serums consist of smaller molecular components, enabling deeper penetration into the skin and enhancing their overall effectiveness. The developed formulation shows strong potential as a natural, effective, and high-quality addition to lip care regimens, suitable for use both during the day and at night as needed. However, further advanced studies are necessary to evaluate its efficacy and safety in a larger population.

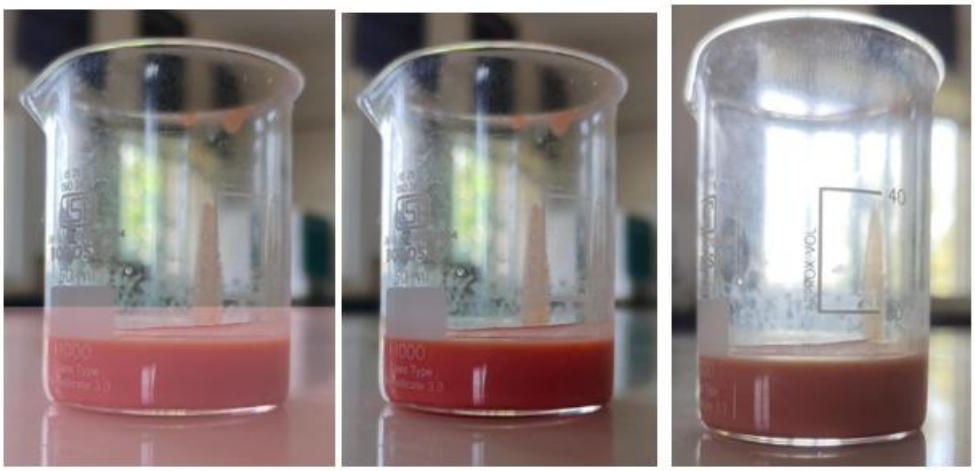
Keywords: Herbal lip serum, SPF, Photoprotection, Lip care, Zinc oxide, Almond oil

1.INTRODUCTION

Lips are one of the most exposed and delicate parts of the body and lack melanin, the natural pigment responsible for protection against sunlight. Therefore, they are highly susceptible to damage from ultraviolet (UV) radiation. UV-A and UV-B rays can lead to dryness, dehydration, sunburn, cracking, and peeling of the lips.

Herbal lip serum with SPF offers protection against UV radiation while also providing hydration, healing, and aesthetic enhancement. Key ingredients such as Almond oil and zincoxide contribute to the sun protection properties of the formulation. The Almond oil nourishes the lip, while coconut oil imparts a soothing, healing effect and adds natural gloss to the lips.

Lip serum is considered an advanced lip care formulation designed to deliver deep hydration and nourishment. Compared to lip oils, which primarily form a superficial barrier, lip serums contain higher concentrations of active ingredients that penetrate more effectively to address specific concerns such as repair of damaged lips, reduction of fine lines, and intensive moisturization.



Batch – F1 Batch – F2 Batch – F3

Fig. 1. Herbal Lip Serum

2.Literature Review

2.1 Background and rationale

Herbal lip serum is a natural lip care product made using herbal ingredients. It is designed to provide deep hydration, nourishment, and protection to the lips without causing harmful side effects. Unlike regular lip products, herbal lip serums contain active ingredients that work effectively on dry and damaged lips.

Lips are easily damaged by UV rays because they do not have melanin and are always exposed to the environment. Many lip products contain chemicals that may cause irritation, so a safer option is needed.

Natural ingredients like almond oil, beeswax, shea butter, peppermint oil, vitamin E, Aloevera gel, Beetroot exreact and zinc oxide help in moisturizing, healing, and protecting the lips from UV damage. Since there is limited research on herbal lip serums with SPF, this study aims to develop a safe and effective natural lip care product.

2.2 Herbs and actives commonly used

- **Cocos nucifera (coconut oil)**: Emollient, Healing and soothing agent
- **Prunus amygdalusdulcis (almond oil)**: Natural moisturizer, Anti-oxidant agent
- **Aloe barbadensis Miller (Aloevera gel)**: Hydrating, Healing agent
- **Beeswax**: Thickening agent
- **Shea butter**: Softening agent
- **Zinc oxide:** Natural SPF agent
- **Vitamin E oil:** Antioxidant
- **Essential oil (mint oil):** Fragrance
- **Beetroot extract:** Natural coloring agent

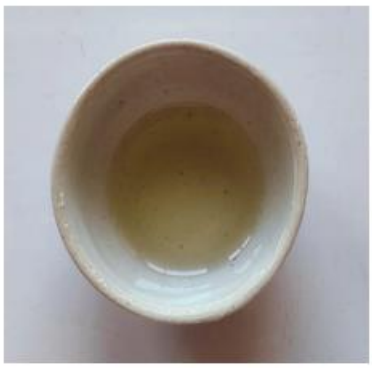
2.3 Typical Formulation Approaches

Fusion Method (Melting Method)— In this method, beeswax, shea butter, and selected oils are taken and melted together using a water bath until a uniform liquid mixture is formed. Zinc oxide is then added slowly with continuous stirring to ensure proper dispersion. The mixture is allowed to cool slightly, after which herbal extracts and Vitamin E are incorporated. Finally, essential oil is added for flavor, and the formulation is mixed thoroughly, poured into suitable containers, and allowed to cool at room temperature.

2.4Standard Evaluation Tests

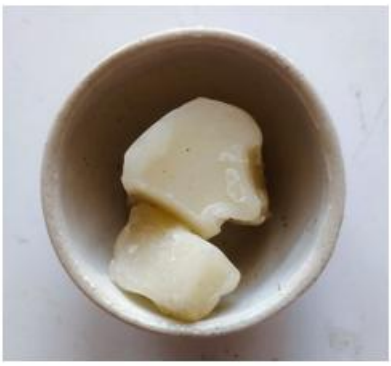
- Organoleptic Properties (Colour, Odour, Consistency, Texture)
- Spreadability Test
- Irritancy test
- pH Measurement
- Viscosity Test
- Homogeneity
- Determination of SPF

3.Materials and methods



Coconut oil

Aloevera gel



Beeswax

Mint oil

Almond oil

Shea butter

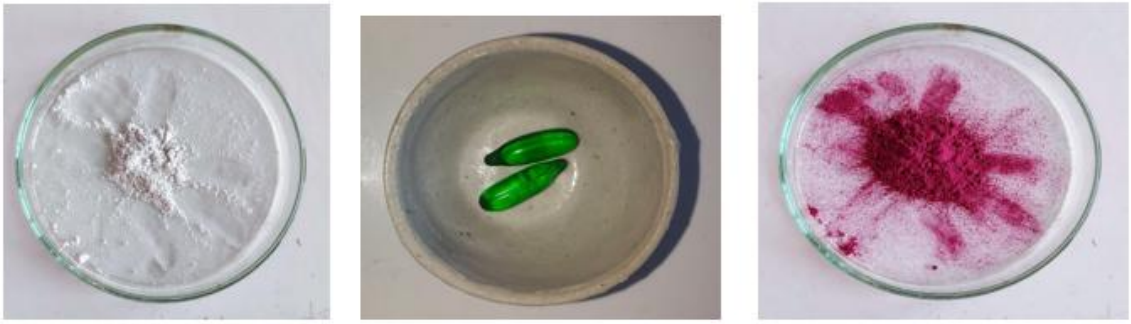


Fig. 2. Herbs and Actives used in this formulation

4.Formulation Table

Ingredients	F1	F2	F3	Role
Coconut oil	6g	5g	4g	Moisturizer, Base
Almond oil	4g	4g	5g	Nourishment
Beeswax	5g	3g	4g	Thickening agent
Shea butter	1g	2g	2g	Softening agent
Aloe vera gel	1g	2g	2g	Healing agent
Zinc oxide	1g	2g	1.5g	Natural SPF agent
Vitamin E oil	0.8g	0.5g	0.5g	Antioxidant
Essential oil (mint)	0.4g	0.5g	0.5g	Fragrance, Flavouring agent
Beetroot powder	0.8g	1g	0.5g	Natural coloring agent

5.Formulation of Herbal Lip Serum

Herbal Lip Serum formulated by Fusion Method.

Step 1: Take beeswax, coconut oil, almond oil, shea butter in a clean beaker.

Step 2: Heat using water bath until fully melted then remove from heat and allow slight cooling.

Step 3: Add aloe vera gel and mix properly.

Step 4: Add zinc oxide slowly and stir continuously.

Step 5: Add Vitamin E oil and essential oil.

Step 6: Add beetroot powder for natural color.

Step 7: Mix well to get uniform consistency.

Step 8: Pour into small containers or glass bottle.

6.Storage

The prepared herbal lip serum should be stored in clean, dry, and airtight containers to prevent contamination and oxidation. It should be kept in a cool and dry place, away from direct sunlight and heat, as high temperature may melt the formulation and degrade sensitive ingredients like herbal extracts and Vitamin E. The product should preferably be stored at room temperature (below 25°C) to maintain its consistency and stability. Containers should be tightly closed after each use to avoid moisture entry and oxidation of oils.

7.Evaluation Parameter

1. ORGANOLEPTIC PROPERTIES

All prepared formulations were evaluated for their organoleptic characteristics, including color, odour, texture, appearance, and consistency. The developed lip serum formulations were assessed visually to determine their overall appearance and consistency. Each formulation was carefully observed for a smooth and uniform texture. Visual examination was also performed to confirm uniformity in color and texture and to ensure that the formulations were free from any foreign particles.

2. HOMOGENEITY

The homogeneity and consistency of the formulations were assessed by examining the physical appearance of the prepared formulations.

3. SPREADABILITY

The spreadability of the lip serum was determined by the glass slide method. A circle of 1 cm diameter was marked at the center of a glass slide, and 0.5 g of the lip serum was placed within the marked area. A second glass slide was carefully positioned over the first to form a sandwich-like arrangement. A weight of 500 g was then placed on the upper slide and allowed to remain for 5 minutes. After removing the weight, the increase in the diameter of the spread sample was measured three times, and the average diameter was calculated.

$$S=d2 \times \pi/4$$

Where, S =Spreading area depending on mass (mm2)

d=spreading area diameter (mm)

4. IRRITANCY TEST

The prepared lip serum formulation was applied to the hairless, soft area of the hand and observed for any signs of irritation at the application site within 24 hours after application.

5. VISCOSITY

The viscosity of the prepared formulations was determined using a Brookfield viscometer. The lip serum was tested at a rotational speed of 100 rpm with spindle LV61, and the corresponding dial reading was recorded.

6. pH MEASUREMENT

The pH meter was initially calibrated with a standard buffer solution. Then, 0.5 g of the lip serum was accurately weighed and dissolved in 50 ml of distilled water. The pH of the lip serum was subsequently measured using the calibrated pH meter.

7. DETERMINATION OF SPF

Method: UV Spectrophotometric Determination of SPF

Principle:

The SPF of the herbal lip serum was determined by measuring its absorbance in the UV-B region (290–320 nm). A higher absorbance indicated better sun protection ability.

Procedure:

The herbal lip serum sample (1 g) was accurately weighed and dissolved in ethanol. The volume was made up to 100 ml to prepare the stock solution. The solution was further diluted to obtain a clear sample suitable for analysis.

The absorbance of the prepared solution was measured using a UV spectrophotometer at wavelengths ranging from 290 nm to 320 nm, at intervals of 5 nm (i.e., 290, 295, 300, 305, 310, 315, and 320 nm). Ethanol was used as a blank during the analysis.

SPF Calculation Formula: $SPF = CF \sum_{290}^{320} EE(\lambda) \times I(\lambda) Abs(c)$

Were, CF= correction factor

EE[λ] = Erythemal effect spectrum

Abs[λ] = Absorbance of product

EE values are constant

Calculation:

The SPF value was calculated using the above formula, where CF (correction factor) was taken as 10. The values of EE(λ) × I(λ) was obtained from standard literature, and the absorbance values at each wavelength were substituted into the equation. The summation of all values gave the final SPF of the formulation.

8.RESULT And DISSCUSSION

1. ORGANOLEPTIC PROPERTIES:

All prepared formulations were evaluated for organoleptic properties. Color, odour, consistency and texture of all three formulations was examined physically.

Parameter	F1	F2	F3
Color	Light Pink	Pink	Light Pink
Odour	Pleasant	Pleasant	Pleasant
Consistency	Thick	Light serum like	Creamy
Texture	Smooth	Smooth	Smooth

2. HOMOGENITY:

The Three developed formulations showed good homogeneity, as indicated by uniform color distribution, absence of phase separation, and the lack of lumps or coarse particles in the lip serum.

Parameter	F1	F2	F3
Homogeneity	Fair	Excellent	Good

3. SPREADABILITY:

All three formulations were evaluated for spreadability. In this test, the area covered by a fixed quantity of the serum was measured after it was uniformly spread on a glass slide.

Parameter	F1	F2	F3
Spreadability	Good	Excellent	Fair

4. IRRITANCY TEST:

The prepared serum formulations showed no signs of redness, edema, rashes, inflammation, or irritation within 24 hours of application. The absence of irritation or allergic reactions indicated that the prepared serum formulations were safe for use on the lips.

Parameter	F1	F2	F3
Irritancy	Nil	Nil	Nil

5. VISCOSITY:

Viscosity of the prepared formulations was evaluated with Brookfield viscometer. The lip serum was rotated at 100 rotations per minute and the corresponding dial reading are as follows:

Parameter	F1	F2	F3
Viscosity (CP)	39.5	30.6	28.3

6. pH:

The pH of cosmetic preparations should remain within an appropriate range to maintain the stability and safety of the formulation during application to the skin. The formulation should not cause any irritation to the lips after use. Therefore, all prepared formulations were evaluated for their pH.

The pH values obtained from the pH meter were found to be between 4.0 and 6.0, indicating that the formulations were suitable for lip application because this range is compatible with the natural pH of the lips.

Parameter	F1	F2	F3
pH	5.1	4.3	5.3

7. SPF DETERMINATION:

The SPF of the formulated lip serum was determined using n-hexane as the diluent. The samples were scanned within the wavelength range of 290–320 nm, and the SPF values of all three formulations were recorded.

Parameter	F1	F2	F3
SPF	1.025	3.195	1.750

SPF is a quantitative measure of the ability of a lip serum formulation to protect against sunburn and other skin damage caused by ultraviolet radiation. An effective lip serum with SPF should exhibit broad absorbance within the 290–320 nm wavelength range. The SPF was determined by the UV spectrophotometric method using Mansur's equation. The obtained SPF values showed that all formulations possessed good UV-absorbing properties, with formulation 2 demonstrating comparatively better protection.

9. SUMMARY And CONCLUSION

The combination of almond oil, coconut oil, zinc oxide, shea butter, beeswax, peppermint oil, aloe vera gel and vitamin E oil in an herbal lip serum has good potential in cosmetic products. The main aim of this study was to prepare and evaluate an herbal lip serum using these natural ingredients. The serum was prepared by first melting beeswax and shea butter in a water bath. After that, almond oil, coconut oil, zinc oxide, and other ingredients were added and mixed well to form a smooth mixture.

Three formulations, named F1, F2, and F3, were prepared by changing the concentration of coconut oil, zinc oxide, shea butter, beeswax and other ingredients. These formulations were evaluated for different properties such as appearance, homogeneity, spreadability, SPF value, short-term stability, skin irritation, pH, and viscosity.

From the evaluation results, formulation F2 was found to be the best among all three formulations because it showed better consistency, good SPF value, and proper homogeneity during the study. Its pH, texture, and spreadability were also within the suitable range. The prepared herbal lip serum was stable, easy to apply, and provided moisturizing and sun protection effects. It also helped reduce dark, dry, and chapped lips while giving a shiny appearance. Also include peppermint oil, which gave cooling effect on lip Since the preparation method was simple and cost effective, it may be useful for large-scale production in the future.

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How to cite this article:
Pratibha S. Dabane et al. Ijsrm.Human, 2026; Vol. 29 (4): 50-58.
Conflict of Interest Statement: All authors have nothing else to disclose.