

Formulation and Evaluation of a Polyherbal Lip Scrub Containing Beetroot, Licorice, and Aloe Vera

Sayli S. Saw^{1*}, Deepak Mourya¹, Shubham Singh², Sanjesh Rathi³

Abstract

The current research is aimed at developing and assessing a polyherbal lip scrub which contains beetroot extract, licorice extract and aloe vera gel to enhance better exfoliation, nutritional and depigmentation. The fusion method was applied to the herbal extract formulations by varying systematically the concentration of the herbal extracts to develop the 4 formulations (F1–F4) each of 15 g. These prepared formulations were tested on their important physicochemical and functional properties such as pH, spreadability, viscosity, homogeneity, washability, skin irritation, and stability. All the formulations showed acceptable properties with a pH range of 4.05 to 4.32, which were suitable to use in lips. The spreadability was between 4.5 and 5.6 cm with formulation F2 having the highest value (5.6 cm), which means that the formulation is easy to apply. The range present was 4200–6200 cP with F2 being in optimal position of balance between firmness and spreadability. Good homogeneity of all batches, uniform distribution of exfoliating particles, no phase separation. There was no irritation, redness, or inflammation at the time of the skin compatibility study. The stability studies were realized under the long-term and under the accelerated conditions the studies have shown no significant changes in the physicochemical properties. Of all the formulations, F2 was found as the optimized batch, based on its balanced mix, good spreadability, sufficient viscosity and stability in general. These results indicate that the designed polyherbal lip scrub is a stable and well-working formulation that could provide a gentle exfoliation effect as well as an increased lip care option making it a promising natural substitute of conventional products.

Keywords: Polyherbal lip scrub, beetroot extract, licorice, aloe vera, exfoliation, natural cosmetics, depigmentation, stability

INTRODUCTION

The lips are one of the most delicate and exposed part of the human body in which there are no sebaceous glands and so are highly susceptible to drying out, cracking, pigmenting and damage due to other environmental factors such as ultraviolet radiations, pollution, and lifestyle habits. Traditional lip care products, in particular lip scrubs, are mainly designed to offer exfoliation and moisturization, but generally lack other therapeutic properties such as depigmentation or long-term nourishment [1]. Additionally, the fact that most of commercial formulations include synthetic components may result in irritation or otherwise undesirable effects which further lends credence to the fact that more natural and safer formulations should be given preference [2]. Herbal and polyherbal cosmetic formulations have received significant attention in recent years based on their safety, biocompatibility

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and multifunctional characteristics. Polyherbal systems are the mixtures of plant-based elements that demonstrate an increased effect through a synergistic process. Licorice (*Glycyrrhiza glabra*) is commonly known to have depigmenting and anti-inflammatory properties, and aloe vera (*Aloe barbadensis*) is known to have excellent depigmenting, moisturizing and healing effect. Beetroot (*Beta vulgaris*) is a natural coloring agent; it is an excellent applicant to enhance the looks and nourishment of the lips. Despite a bunch of different herbal lip scrubs on the market, most recipes are constrained to a few basic steps of exfoliation and hydration without the necessary focus on depigmentation and general lip care [3]. Thus, the current research will develop and analyze a polyherbal lip scrub with beetroot extract, licorice extract, and aloe vera gel. The aim is to create a balanced, safe and effective formulation that delivers gentle exfoliation and increased nourishment and depigmentation thus providing a natural alternative to the conventional lip care products.

MATERIALS AND METHODS

Materials

Beetroot powder and licorice root were bought in a local Ayurvedic shop in Ahmedabad, India. The Aloe vera gel was bought at a commercial herbal distributor. Beeswax and coconut oil were used as the base materials. A natural exfoliating agent, namely fine sugar, was used and glycerin was used as a humectant. As the antioxidant, vitamin E oil was added, and sodium benzoate was employed as a preservative. All chemicals and reagents used were of analytical or cosmetic grade and used without further purification. The use of distilled water was utilized in the study.

Preparation of Herbal Extracts

Preparation of Beetroot Extract

An aqueous-based extraction process was carried out on the beetroot extract under controlled conditions. The finely powdered beetroot, in 3 g, was carefully weighed using an analytical balance scale and transferred into a clean, dry beaker. It was then gently added in increments of 20 mL until the powdered substance was entirely dissolved. 20 mL of distilled water was gradually added to the powder and the solution stirred. This mixture was stirred within a time range of 5–10 min to enable dissolution of water-soluble constituents and then the mixture was subjected to the maceration process at room temperature, within a time range of 30 min to allow total extraction of the food constituents. After rambling, the mixture was initially filtered through muslin cloth to remove the coarse particles and the filtrate was further clarified by the passage through Whatman No. 1 filter paper to obtain a clear extract free of particles [4]. Obtained filtrate was placed in clean and amber colored container to minimize degradation caused by light and was utilized immediately to make formulation to provide stability and efficacy of active constituents (Figure 1).



Figure 1. Extracts of beetroot extract and licorice.

Preparation of Licorice Extract

This licorice extract was achieved by an aqueous technique of Maceration.

Mechanical Grinder

The dried licorice roots were first washed to remove impurities, before grinding the roots into a fine powder using a mechanical grinder. A weighing precision of around 4 g of the powdered material was weighed accurately and transferred to a clean beaker. Then, a gradual addition of 25 mL of preheated at 40 to 50 degree C distilled water was introduced with constant stirring to make the powder completely dispersed. The mixture was left to stand, unshaken and at room temperature, 30 min to carry out the procedure of maceration. After extraction, the mixture was filtered first using muslin cloth to remove rough particles and secondly using Whatman No. 1 filter paper to eliminate coarse particles to achieve a clear extract containing no particles. The product was filtered and then transferred into a clean amber-colored container to ensure that the product is not degraded due to light destruction and utilized immediately as the product in a formulated product [5, 6].

Formulation Design

The design and formulation of the four different batches (F1, F2, F3, F4) of polyherbal lip scrub were geared towards the optimization of the concentration of the herbal actives and the desirable physicochemical and functional characteristics. The level of formulation variables included different proportions of beet root extract, licorice extract and aloe vera gel, but the amounts of base materials and excipients were varied accordingly to ensure no changes in the characteristics of the finished products namely the texture, spreadability and stability. To maintain a consistent exfoliating efficacy, fine sugar was held constant in all batches. Each formulation was weighed to a total of 15 g to allow a direct comparison of evaluation parameters. All formulations given are shown in Table 1 which demonstrates how the components of the herbs can be systematically varied and the corresponding adjustment of base constituents made. Such a design technique enabled a search of an ideal formulation with balanced properties in both aspects in terms of texture, homogeneity, and user acceptability [5].

Table 1. Composition of polyherbal lip scrub formulations (F1–F4).

Ingredients	F1 (g)	F2 (g)	F3 (g)	F4 (g)
Beetroot extract	0.50	0.75	1.00	1.25
Licorice extract	0.30	0.45	0.60	0.75
Aloe vera gel	1.00	1.50	2.00	2.50
Fine sugar	6.00	6.00	6.00	6.00
Beeswax	2.50	2.25	2.00	1.75
Coconut oil	4.00	3.75	3.50	3.00
Glycerin	0.30	0.30	0.30	0.30
Vitamin E	0.15	0.15	0.15	0.15
Sodium benzoate	0.15	0.15	0.15	0.15
Total (g)	15	15	15	15

Method of Preparation

The polyherbal lip scrub was packed through fusion method controlling the temperature, the mixture continued, resulting in uniformity of formulation. To prepare a clear and homogeneous oil phase first beeswax and coconut oil were weighed and transferred into a clean and homogeneous beaker followed by a melting process in water bath maintained at $55 \pm 2^\circ\text{C}$. There was no overheating done to ensure it did not degenerate the lipid constituents. In another beaker, aqueous phase was prepared by mixing aloe vera gel, beetroot extract, licorice extract, glycerin and vitamin E oil in an irregular agitator and stirred to achieve the uniform dispersion. The ready aqueous solution was then gradually poured to the hot oil solution under constant stirring so as to facilitate an appropriate mixing and patina formation of a semi-solid base. The mixture was stirred a bit of between 10 and 15 min to allow mixing of all ingredients uniformly. Sodium benzoate was added as a preservative and the mixture was thoroughly mixed. Then fine sugar was gradually added as exfoliating agent with slow stirring to prevent agglomeration, and to provide uniform distribution of the particles throughout the formulation. The mixture was stirred, until a smooth, homogeneous consistency has been reached. The ready formulation was then slowly allowed

to cool to room temperature with the constant stirring to prevent phase separation and ensure correct setting of the scrub. Lastly, the formulation was brought into clean, dry, airtight containers where they were stored at ambient conditions to further evaluate [5, 6].

EVALUATION OF POLYHERBAL LIP SCRUB

Organoleptic Evaluation

The compositions of the prepared polymethyl benzene lip scrub were measured using the organoleptic properties, color, smell, feel and physical appearance. The test was conducted by visual assessment in normal light conditions in room temperature. Color was also evaluated in terms of uniformity and intensity, odor was also evaluated in terms of acceptability and absence of any unpleasant smelling odor, and texture was also evaluated by hand evaluation to have an evaluation of smoothness and even consistency. The homogeneity, glossiness and the existence of any phase separation or visible particles in the overall appearance of the formulations were observed. These observations were made to determine the aesthetic quality and user acceptability of the formulations [7, 8].

pH Determination

To determine the appropriateness of the prepared formulations to lip application, determination of the pH of the prepared formulations had to be done. A 1 g of the lip scrub was weighed carefully and dissolved in 10 mL of distilled water stirred. A draw of water was placed at room temperature to obtain the results for the pH of the resulting dispersion with a calibrated digital pH meter. The electrode was washed with distilled water at the beginning and end of each reading, to guarantee accuracy, and reading values were given in triplicate [9].

Homogeneity and Grittiness

The homogeneity of the formulations was analyzed by visual check to ensure that there was uniform distribution of all the ingredients and that there was no phase separation. The assessment of grittiness was performed manually through the application of a small amount of the formulation between the fingers to ascertain the presence, uniformity, and smoothness of the exfoliating particles, making sure not to have rough or sharp particles that could cause irritation [10].

Spreadability

The glass slide method was used to determine the spreadability of the formulations. Between two clean slides of glass, a weight of known weight was placed on the upper slide to spread the formulation evenly between the two slides. The distance that the upper slide takes a specific distance was measured [11]. The spreadability was computed by the following equation:

$$S = \frac{M \times L}{T}$$

where S is the spreadability, M is the applied weight (g), L is the length moved by the slide (cm), and T is the time taken (s).

Washability Test

Washability Washability of the formulation was determined by applying a small amount of the formulation to the surface of the skin and then rinsing the area with tap water. The ease with which it could be removed, any residues left following the washing process, and the level of cleanliness after the washing process were monitored and noted to determine the level of practical usability of the formulation [12].

Skin Irritation Test

To evaluate the potential of the formulations as skin irritants, a small amount of the lip scrub was applied to a specific area of the skin (forearm). Any signs of irritation, redness, itching or inflammation were followed in the applied area over a period of 10 min. A lack of these types of reactions demonstrated that the formulation was safe to use topically [13].

Viscosity Measurement

The viscosity of the formulations was found with the help of a Brookfield viscometer with an appropriate spindle. At room temperature the rotational speed was kept constant and the measurement was made. The required amount of the formulation was then put in the sample holder, and the viscosity values were recorded after the instrument became in equilibrium. To get a reproducible result, measurements were also done in triplicate [14].

Stability Study

Stability tests were carried out to assess the impact of the storage conditions to the physicochemical characteristics of the formulations. Samples were stored under both long-term conditions ($25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ / $60\% \text{ RH} \pm 5\% \text{ RH}$) and accelerated conditions ($40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ / $75\% \text{ RH} \pm 5\% \text{ RH}$). The formulations underwent assessment at set intervals with regards to changes in pH, viscosity, color and fragrance, consistency and phase separation. The observations were taken to determine the stability and shelf-life of the formulations [14].

RESULTS AND DISCUSSION

Organoleptic Evaluation

All formulations portrayed satisfactory levels have organoleptic features including color, odor and texture. The addition of beetroot extract provided an aesthetic reddish color and as the concentration increased, the color became darker, starting with F1 then moving on to F2, F3 and F4. Formulation F2 and F3 showed the best desired appearance with a smooth texture and a pleasant smell compared to F4 which had a darker look with a rough texture and unpleasant smell because of the higher content of herbs. The details are observed as in Table 2 and formulation picture were in Figure 2.

Table 2. Organoleptic properties of polyherbal lip scrub.

Formulation	Color	Odor	Texture	Appearance
F1	Light pink	Mild herbal	Smooth	Uniform.
F2	Pink-red	Pleasant	Smooth	Uniform & glossy.
F3	Reddish	Herbal	Slightly thick	Uniform.
F4	Dark red	Strong	Thick	Slightly dense



Figure 2. Polyherbal lip scrub formulations: (A) F1, (B) F2, (C) F3, and (D) F4.

pH Determination

pH of any formulation was in the range of 4.05 and 4.32 which is appropriate in lip application and in a range which would be acceptable in physiological application. Minimal fall in pH was seen with an increase in herb concentration. Table 3 and bar graph shown in Figure 3 present the results of the data presented in Table 1.

Table 3. pH of polyherbal lip scrub formulations.

Formulation	pH
F1	4.32
F2	4.18
F3	4.10
F4	4.05

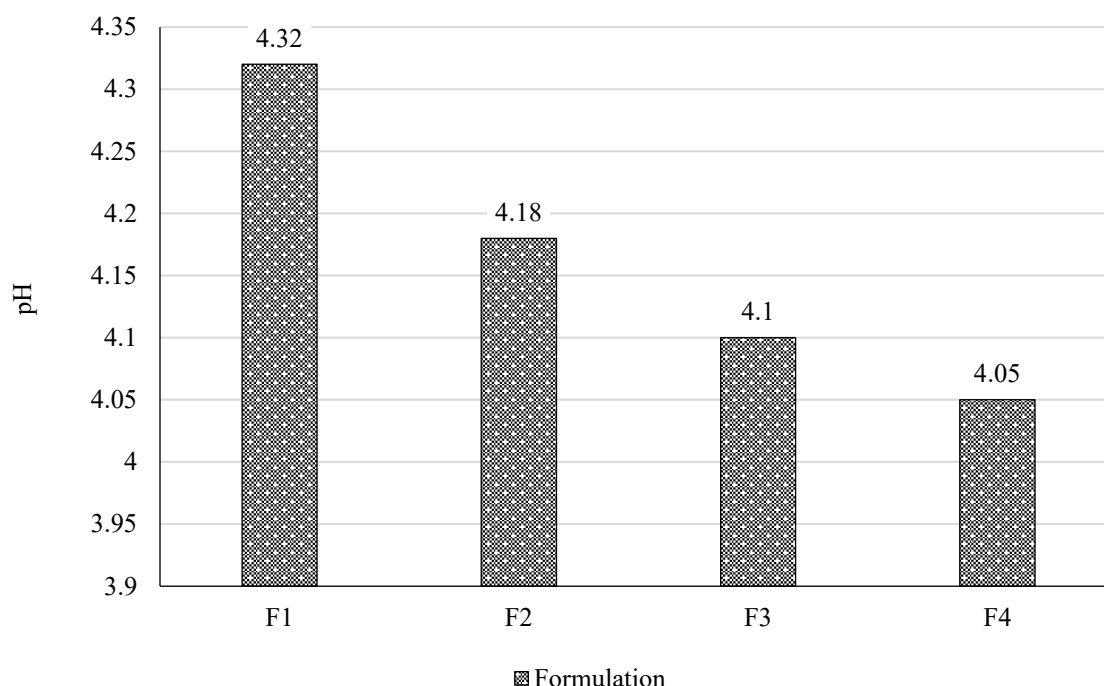


Figure 3. pH profile of polyherbal lip scrub.

Homogeneity and Grittiness

All formulations were well homogeneous, and the exfoliating particles were uniformly distributed and there was no phase separation. The grittiness was optimum in F2 and F3 which offers effective exfoliation without causing irritations whereas F4 showed slightly higher abrasiveness due to enhancement of solid content. Table 4 summarizes the results of the study.

Table 4. Homogeneity and grittiness evaluation.

Formulation	Homogeneity	Grittiness Level	Phase separation
F1	Good	Moderate	No.
F2	Excellent	Optimal	No.
F3	Excellent	Optimal	No.
F4	Good	Slightly high	No.

Spreadability

One of the important parameters that influence user acceptability relates to spreadability. Formulations F2 and F3 were more spreadable with balanced composition whereas F1 was slightly oily and F4 had a lower spreadability rate as it was very high in viscosity. The findings are given in Table 5 and graphically represented in Figure 4.

Table 5. Spreadability of formulations.

Formulation	Spreadability (cm)
F1	4.8
F2	5.6
F3	5.3
F4	4.5

Washability Test

All the formulations were readily solvable in water, and they did not leave any residue, which indicated an acceptable balance between the number of hydrophilic and lipophilic components. Formulation F2 and F3 had a relatively high washability. Table 6 shows the results.

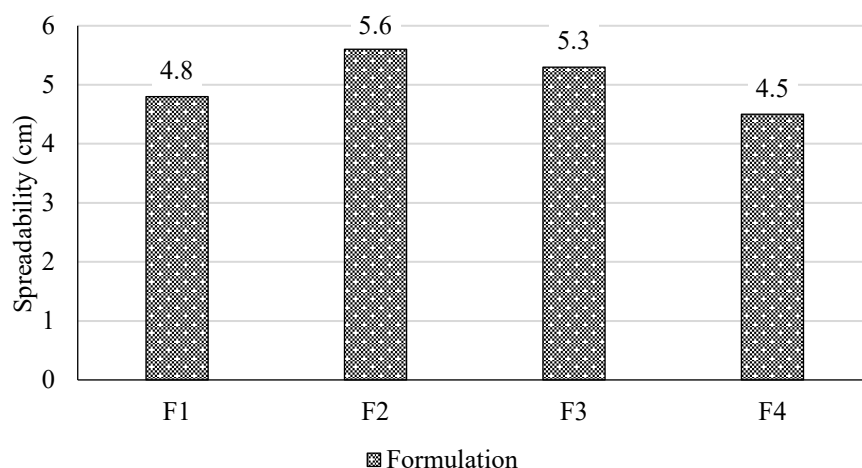


Figure 4. Spreadability of polyherbal lip scrub.

Table 6. Washability of formulations.

Formulation	Washability
F1	Good.
F2	Excellent.
F3	Excellent.
F4	Good.

Skin Irritation Test

There were no traces of irritation, redness or inflammation observed in any formulation, which is reassuring about the safety of the developed polyherbal lip scrub. Recap of the results is presented in Table 7.

Table 7. Skin irritation study.

Formulation	Irritation	Redness	Inflammation
F1	No	No	No
F2	No	No	No
F3	No	No	No
F4	No	No	No

Viscosity Study

The viscosity test showed that the consistency increased with the increase in the concentration of the herbal product. Formulation F2 showed the best viscous behavior such that it is highly spread, and the stability is not compromised. The increased viscosity in F4 also helped to decrease the spreadability. Table 8 provides the results.

Table 8. Viscosity of formulations.

Formulation	Viscosity (cP)
F1	4200
F2	5100
F3	5450
F4	6200

Stability Study

Stability tests attributed that all formulations were stable and showed no significant alterations in physicochemical character. Slight thickening was observed in F4 due to higher herbal content. Table 9 shows the results.

Table 9. Stability study.

Formulation	Appearance	Stability
F1	Stable	Good.
F2	Stable	Excellent.
F3	Stable	Excellent.
F4	Slight thickening	Good.

Optimization and Comparison

Formulation F2 was the optimized formulation that was identified based on evaluation parameters (Tables 2–9) and graphical analysis (Figures 1–4). It had a balanced pH, excellent spreadability, optimal viscosity, high stability, and high antioxidant value. F2 has shown better behavior compared to marketed formulations in terms of spreadability, safety and usefulness properties. The optimized formulation will offer balanced combination of exfoliation, depigmentation and antioxidant protection which is promising as a natural alternative to lip care.

CONCLUSION

The current project has succeeded in creating and testing a polyherbal lip scrub in terms of natural constituents beetroot extract, licorice extract and aloe vera gel. The batches developed had satisfactory physicochemical and functional properties observed such as acceptable pH, good homogeneity, perfect spreadability, good exfoliation, and easy washability. Among all the formulations, F2 had best been defined as an optimized formulation regarding the balanced formulation, desirable texture and excellent performance in evaluation parameters. Herbal ingestion helped in enhancing nutrition and possibly depigmenting its users without loss of user acceptability. As a result, stability studies revealed that the formulation was stable during storage without any significant difference in terms of physical characteristics. Altogether, the created polyherbal lip scrub is a safe, effective and natural alternative to traditional lip care products. But the research has some limitations. The assessment was majorly restricted to in-vitro and basic cosmetic test and no clinical or in-vivo test was carried out to address the long-term efficacy and safety on human lips. Also, the study had not involved any further analytical characterization or any further stability studies than that taken up in the test. Hence, it is suggested that additional studies on conclusion evaluation based on clinical evaluation, stability analysis and feasibility of large-scale production are required to prove the validity of the formulation to be used commercially.

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Conflict of Interest

NIL

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