



Beetroot-infused herbal lipstick: Formulation and evaluation

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ABSTRACT

The formulation and evaluation of a therapeutic lipstick incorporating beetroot as a natural coloring agent was undertaken to explore its potential benefits for skin health. Beetroot, known for its rich antioxidant properties, provides a vibrant, safe, and eco-friendly alternative to synthetic dyes commonly used in cosmetic formulations. In this study, various lipstick formulations were developed using beetroot extract, along with traditional cosmetic ingredients such as waxes and oils. The physical and chemical properties of the lipstick, including color intensity, texture, stability, and moisturizing effects, were evaluated. Additionally, skin compatibility and overall safety were assessed. The results indicated that the beetroot-based lipstick demonstrated favorable aesthetic qualities, along with therapeutic benefits such as enhanced skin hydration and protection against oxidative stress. This study highlights the feasibility of utilizing natural ingredients, specifically beetroot, in cosmetic formulations with added therapeutic significance, paving the way for more sustainable and health-conscious beauty products.

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INTRODUCTION

The cosmetics industry is continuously evolving, with consumers increasingly seeking products that not only enhance beauty but also offer therapeutic benefits. Lipstick is one of the most widely used cosmetic products, primarily designed to enhance the color and appearance of the lips. It is available in a variety of shades, finishes, and formulations, catering to diverse consumer preferences. The primary components of lipstick include pigments, waxes, oils, and emollients. Pigments provide the color, while waxes give the product structure and ensure it stays solid at room temperature. Oils and emollients help to create a smooth texture, making the lipstick easy to apply, and also contribute to its moisturizing properties. However, growing concerns about the potential harmful effects of synthetic ingredients have led to a rising demand for natural, skin-friendly alternatives. Among these, beetroot has emerged as a promising natural ingredient due to its rich content of bioactive compounds, such as antioxidants, vitamins, and minerals, which are beneficial for skin health [1].

Beetroot, commonly known for its vibrant red color, has been widely utilized in food products, but its application in cosmetics, particularly in lipstick formulations, is relatively unexplored. Apart from its ability to impart a natural and striking hue, beetroot is believed to possess therapeutic properties that can nourish and protect the skin. These properties include antioxidant effects, hydration, and potential anti-aging benefits, making it an ideal candidate for inclusion in cosmetic formulations.

Beetroot (*Beta vulgaris*) is a root vegetable known for its vibrant red color, distinct earthy flavor, and numerous health benefits. Beyond its culinary uses, beetroot has gained attention in the fields of nutrition, skincare, and cosmetics due to its rich nutrient profile, which includes antioxidants, vitamins (such as vitamin C, folate, and B6), minerals (like potassium, magnesium, and iron), and fiber. It also contains betalains—natural pigments responsible for its red and yellow colors—along with flavonoids and carotenoids, which have been recognized for their antioxidant and anti-inflammatory properties [2,3]. In the realm of skincare and

cosmetics, beetroot has been explored for its therapeutic qualities. Its antioxidants help neutralize free radicals, thereby protecting the skin from oxidative stress, which can lead to premature aging [4].

Beetroot is also known to have moisturizing properties, helping to keep the skin hydrated. Additionally, its high vitamin C content supports collagen production, which is vital for skin elasticity and regeneration [5].

This study aims to formulate and evaluate a lipstick that incorporates beetroot extract as the primary coloring agent, while also exploring its therapeutic potential. By focusing on the physical, chemical, and therapeutic properties of the lipstick, this research seeks to demonstrate the viability of using beetroot not only as a natural colorant but also as a functional ingredient that contributes to skin health. The outcome of this study could pave the way for the development of more sustainable and health-conscious cosmetic products.

MATERIALS AND METHODS

Materials

Beetroot extract was obtained from college laboratory. Beeswax, Castor oil, Lemon oil and Methyl paraben were procured from Loba Chemie, Mumbai. Orange essence was purchased from local market. All other chemicals used are of analytical grade.

Extraction of beetroot

After being sliced into small pieces, 250 fresh *Beta vulgaris* roots were macerated by immersing them in 300 milliliters of 70% ethanol for three days in a row. A rotatory evaporator was used to concentrate the resulting alcoholic extract under low pressure until it was completely dry. Herbal lipstick was created using the resulting extract [6].

Formulation of herbal lipstick

Gently heat the beeswax and castor oil in the bowl till it melt with occasionally stirring. Once the wax and oil mixture is melted, add the Beetroot Extract. Stir thoroughly to ensure the color is evenly distributed throughout the mixture. Once the mixture is well-combined and still warm (but not too hot), add lemon oil and orange essence. Stir to incorporate them evenly into the mixture. While the mixture is still in liquid form, carefully pour it into lipstick molds or empty lipstick tubes. Leave a little space at the

top of the mold for easy application and to ensure the lipstick slides up smoothly from the tube. Allow the lipstick to cool and set at room temperature. The molds are placed in the fridge for quicker setting.

Table 1: Formulation of beetroot-infused herbal lipsticks

Ingredients	F1	F2	F3
Bees Wax (gm)	1.52	1.52	1.52
Castor Oil (ml)	2.16	2.08	2
Lemon Oil (ml)	0.04	0.04	0.04
Beet root extract (gm)	0.24	0.32	0.4
Orange essence (ml)	0.04	0.04	0.04
Methyl paraben (gm)	0.008	0.008	0.008

Evaluation of lipstick Organoleptic properties

Organoleptic characteristics of the lipstick formulation, including color and texture were assessed.

Determination of pH

Using a pH meter, the prepared herbal lipstick's pH was ascertained. To determine the pH, one gram of lipstick was dissolved in one hundred milliliters of pure water [7].

Solubility test

The lipstick was dissolved in a variety of solvents to assess its solubility [8-10].

Determination of melting point

Fill a capillary tube with a small amount of melted lipstick. Cool it until it solidifies inside the tube. Place the tube in a melting point apparatus. Gradually heat and observe the temperature at which the lipstick starts melting. Record the melting range (initial softening to full liquefaction) [8,11-15].

Determination of breaking point

The breaking point is used to calculate the strength of lipstick. One inch from the edge of the support, the lipstick was placed in a horizontal groove. The breaking point was determined by measuring the weight at which the lipstick broke after the weight was gradually increased by 10 grams over 30 seconds [8].

Surface anomalies

The purpose of the analysis was to identify any surface flaws, including fungus, mold contamination, and surface crystal formation.

Perfume stability

The herbal lipsticks were tested for scent after 30 days [8].

Determination of aging stability

For an hour, the lipstick was placed in a hot air oven set at 40°C to evaluate its bleeding, surface crystallization, and ease of application. This was done to ensure that the results were accurate and consistent.

Skin irritation test

It is carried out by applying the product on the skin for 10 min and any sign of irritation is observed [16].

RESULTS AND DISCUSSION

Beetroot-infused herbal lipsticks were successfully formulated by varying the concentration of beetroot extract. Figure 1 shows the final lipstick formulations.



Figure 1: Beetroot-infused herbal lipsticks

The prepared beetroot-infused herbal lipsticks were evaluated for different tests. The results of all tests were shown in Table 2.

Organoleptic properties

Beetroot extract lipstick is a great natural alternative to synthetic lipsticks, offering a beautiful range of reddish purple to burgundy hues with a smooth, moisturizing texture. A smaller concentration of beetroot produces a reddish purple (F1) and deep magenta for the F2 formulation, whilst a higher concentration produces a deeper red or burgundy shade (F3). Natural oil (Castor Oil) contributes to a creamy and smooth texture, making application easy.

Determination of pH

The pH of beetroot extract lipsticks is maintained to 6.5 to preserve its natural reddish hue, ensure skin compatibility, and enhance stability.

Solubility test

Beetroot extract primarily contains betalain pigments, which are highly water-soluble but have limited solubility in non-polar solvents like oils. Ethanol, being a polar solvent, can dissolve certain water-soluble compounds, including betalains. Hydro-alcoholic mixture shows good solvent system to solubilize the beetroot-infused lipstick.

Determination of melting point

The melting point of a lipstick refers to the temperature at which it transitions from a solid to a semi-solid or liquid state. A well-balanced melting point ensures smooth application without being too hard or too soft. Melting point, 63°C give firmness to the lipstick, ensuring stability while allowing smooth application.

Determination of breaking point

The breaking point (45gm) indicates that beeswax gives the lipstick flexibility and solidity, avoiding brittleness.

Surface anomalies

Absence of any defects ensures that wax-to-oil ratio is properly adjusted, smooth blending and following proper cooling techniques during the formulation of lipsticks.

Perfume stability

Perfume stability in beetroot extract lipstick depends on ingredient compatibility, temperature control, and proper storage. Using oil-based fragrances (Lemon Oil and Orange essence), and protecting the lipstick from heat and oxidation can enhance fragrance longevity. Proper formulation ensures that the lipstick retains a pleasant and long-lasting scent without rapid perfume degradation.

Determination of aging stability

Placing the beetroot extract lipstick in a hot air oven at 40°C for one hour helps assess its thermal stability and overall formulation quality. The observation shows there is no bleeding and surface crystallization in lipsticks. The smoothness and consistency of lipstick application after heat exposure was maintained.

Table 2: Evaluation of beetroot-infused herbal lipsticks

Sl. No.	Evaluation parameters	F1	F2	F3
1.	Colour	Reddish purple	Deep magenta	Burgundy
2.	Texture	Smooth	Smooth	Smooth
3.	pH	6.5	6.5	6.5
4.	Solubility test	70% Ethanol	70% Ethanol	70% Ethanol
5.	Melting point	63°C	63°C	63°C
6.	Breaking point	45gm	45gm	45gm
7.	Surface anomalies	No defect	No defect	No defect
8.	Perfume stability	Good	Good	Good
9.	Aging stability	Smooth	Smooth	Smooth
10.	Skin irritation test	No	No	No

Skin irritation test

Upon application lipstick, the lipstick does not cause redness, itching, swelling, or allergic reactions. This might be because of pH, 6.5 which is skin friendly and the beetroot extract which is a natural ingredient, it is generally considered as safe. This well-formulated lipstick would be gentle, non-toxic, and suitable for sensitive skin.

CONCLUSION

The formulation and evaluation of beetroot-infused herbal lipstick aimed to develop a natural, skin-friendly, and effective lip product using beetroot extract as a natural colorant. Through careful selection and combination of waxes, oils, and natural additives, the lipstick was designed to provide moisturization, vibrant pigmentation, and long-lasting wear while minimizing synthetic ingredients. The beetroot-infused herbal lipstick formulation demonstrated good color retention, texture, stability, and safety, making it a viable natural alternative to commercial lipsticks. This study confirms that herbal and natural lipsticks can be effectively formulated without synthetic dyes aligning with consumer demand for clean beauty products.

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