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FORMULATION AND CHARACTERIZATION OF LIPSTICK USING BETA -VULGARIS

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Abstract

This study focuses on the formulation and characterization of a natural and herbal lipstick by using extract of beetroot. Lipsticks are formulations commonly used to improve gorgeousness of lips and add shine to the makeup. Now day's cosmetics are one of the commonly used products in our daily life without considering their side effect, women uses large amount of synthetic cosmetics that produces the side effects on the skin and health. To avoid such side effects, alternate option is available i.e., herbal cosmetics. In this investigation we are presenting the herbal formulation of lipstick using pigment few medicinal important plants we used herbal plant Beetroot (beta vulgaris). Using natural colorants, waxes, perfumes, preservatives, oils, etc., The advantage of herbal lipstick is safe, cost-effective, non-toxic, and pigments used are easily available from plants and vegetables. The aim of the present study which include the formulation and evaluation of herbal lipstick using colour pigments from natural sources such as beetroot. Due to lot of side effects of available synthetic formulation in the market the prepared herbal lipstick evaluated on parameters such as colour, pH parameter, skin irritation, perfume stability. The present study concluded that the use of natural colour formulation having less or no side effects. It has potential to increase customer acceptance because of use of different natural ingredients and harmless colourants used.

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Introduction

Cosmetics are a word comes from the Greek word "Kosmtikos" it means the organization, power and skill in beautifying [1]. These are the formulations that are used to improve the appearance of the human beauty. Cosmetic substances include lipstick, skin care creams, lotions, perfumes, powders, hair colours, nail polish, gels, baby products and other so many products are in huge demand in developing and developed countries [2]. Cosmetic have become one among the daily wants of all teams in society. Every year, users are introduced to numerous new cosmetic product of the most recent trend [3]. Lipstick formulations are most generally accustomed enhance the wonder of lips and add glamour to the touch to the makeup [4]. Herbal cosmetic products have increasing demand in the world market and they are precious gift from the nature. There is broad choice of herbal cosmetic products to convince our beauty regime. Herbal lipsticks are produced from natural colour from frequently available vegetables and plants. Commonly used coloured pigments are beet root, rose, papaya, tomato, carrot, henna, indigo and it is easy to produce blends for our need. The commonly used ingredients for the preparation of lipstick are oil, emollients, waxes and pigments. Such ingredients mainly used for protection of lips, texture and colour. Herbal lipstick contains many natural nutrients are present which are safer to use and it is free from hazardous chemicals and it is safe to consume, therefore herbal lipstick prepared from the natural ingredients from beet root powder, rose water, bees wax. Herbal lipstick contains natural ingredients that are non-toxic as compare to the synthetic agents.

Anatomy of Lips

The lips are a fascinating and vital part of our anatomy, serving as a transition zone between the external skin and the internal oral mucosa [5]. Their unique structure, characterized by a thin,non-keratinized or lightly keratinized epidermis, a rich superficial vascular supply, and a near-complete absence of hair follicles, sebaceous, and sweat glands, makes them particularly vulnerable to environmental stressors like dryness and UV damage [6]. This anatomical distinctiveness is crucial for understanding why lip care, including the formulation of products like beetroot herbal lipstick, must prioritize hydration, protection, and gentle, nourishing ingredients to maintain lip health and aesthetic appeal [7].

Beta Vulgaris

Beta vulgaris is the scientific name of beetroot, which is also commonly known as table beet. In India, beetroot is mainly cultivated in states such as Haryana and Himachal Pradesh [8]. The root imparts a characteristic crimson colour due to its high betalain pigment content [9].Various parts of the beetroot exhibit pharmacological activities including antioxidant, antidepressant, antimicrobial, antifungal, and anti-inflammatory effects [10]. The pH of fresh beetroot is slightly alkaline, typically ranging between 7.5 and 8.0 [11]. It contains significant amounts of vitamins such as vitamin C, B1, B2, B6, and trace amounts of B12 [12]. Beetroot powder is widely used as a natural colouring agent in foods and cosmetics due to its safety and vibrant hue [13]. Morphologically, beetroot typically has a round or slightly elongated shape with smooth, firm, and unblemished skin. Its flesh is most often deep red or purple, although some cultivars are yellow or white.

Synonym: Beetroot, sugar-beet

Source: It is swollen root, dark red- purple colour obtained from a root called *Beta vulgaris.*

Family: *Amaranthaceae.*

Chemical Constituents

Beetroot gives a distinctive colour due to the present of nitrogen containing water soluble pigments betalains.

It is widely used as a natural food colorant which contains a rich source of vitamins, Vitamin- C, Vitamin – B6, folic acid and dietaryfiber, high Antioxidant.

Uses

- Food colouring agent
- Anti-oxidant
- Helps in healing skin cracks
- Anti-diabetic properties
- Hepatoprotective agent.

Types of Lipstick the Lipsticks Are Divided Into Following Types

1) Transparent lipstick
2) Liquid lipstick
3) Lip rouge
4) Matte lipstick
5) Creamy lipstick
6) Lip tint or stain [14].
7) Lip crayon
8) Sheer lipstick
9) Glossy lipstick
10)Pearl lipstick
11)Moisturizing lipstick
12) Lip gloss lipstick [15].

Ideal Characteristics of Herbal Lipstick

1. Herbal lipsticks are smooth and are easy to apply.
2. It is non-toxic and non-irritant.
3. It has different colour, odour, texture and packing and specific plasticity.
4. It is free from contamination.
5. It is free from gritty particles.
6. It does not melt or hard within a variation of climatic temperature.
7. It should be stable in shelf-time and it is free from bloom and sweating during storage condition of the lipstick.
8. It should have a good degree of indelibility.
9. It should be non-drying.
10. It should not lose its shiny appearance during storage.
11. It should remain free from the bloom or sweating during storage.
12. It should be a long lasting.

Materials and Methods

Beetroot (powder), bees wax, candelilla wax, rose oil, vitamin E capsule, olive oil, Vaseline, coconut oil, vanilla essence.

Beetroot Powder: This is the key ingredient for achieving the red colour in your lipstick. You can prepare it by drying and grinding beetroot. Beet powder is a popular natural colouring agent used in beetroot lipsticks. It provides a rich, red-purple hue derived from betalain pigments found in beetroot, offering a safe and vibrant alternative to synthetic dyes. Beetroot powder offers a non-toxic alternative to synthetic dyes.

Bees Wax: Provides a solid base and helps the lipstick hold its shape.Beeswax is commonly used in beetroot lipstick formulations to provide structure, a glossy finish, and to help bind the ingredients together. It acts as a base ingredient, contributing to the lipstick's texture and making it solid at room temperature. Additionally, beeswax can help to create a barrier on the lips, protecting them from environmental factors. Functionally, beeswax forms a thin, protective barrier on the lips, shielding them from environmental aggressors such as wind, cold, and low humidity [16]. Beeswax is perhaps the most essential ingredient in our lip balms. This is because it contains natural moisturizers that lock in moisture from the air and help keep the skin looking firm and plump.

Candelilla Wax: Candelilla wax is a popular ingredient in beetroot lipstick formulations due to its ability to provide shine, bind oils, and add hardness to the product. It is a

vegan alternative to beeswax and can help create a smooth, emollient texture in lipstick.

Rose oil: Rose oil is used in beetroot lipstick primarily for its fragrance and potential moisturizing properties. It adds a pleasant scent to the lipstick and can help to create a more natural aroma. Additionally, rose oil can contribute to the overall moisturizing effect of the lipstick, potentially softening and nourishing the lips.

Vitamin E capsule: Vitamin E is a powerful antioxidant that can help protect lips from environmental damage and premature aging.

Olive oil: Olive oil is a common ingredient in homemade and natural lipstick recipes, especially when using beetroot as a coloring agent. It acts as a blending agent, helping to incorporate the wax and oil phases, and also aids in dispersing the beetroot pigment.

Coconut Oil: Coconut oil is known for its hydrating properties, making it a great addition to lip products to prevent dryness and chapping. It also offers mild sun protection, which can be beneficial for the delicate lip skin.

Vaseline: Vaseline is often used as a moisturizing base and to help create a smooth, creamy consistency. It acts as an emollient, locking in moisture. Vaseline, a brand name for petroleum jelly, is a semi-solid mixture of hydrocarbons obtained from petroleum refining. It is widely used in cosmetic formulations as an emollient and moisturizing base. In herbal lipstick formulations, Vaseline helps create a smooth, creamy consistency and enhances product spreadability [17].

Its primary function is to lock in moisture by forming an occlusive layer on the skin's surface, thereby reducing transepidermal water loss (TEWL) and improving skin hydration [18]. This occlusive property makes Vaseline especially beneficial for protecting lips from dryness, cracking, and environmental exposure. Additionally, its inert nature ensures that it is non-irritating and suitable for sensitive skin [19].

Vanilla Essence: Vanilla essence is used in beetroot lipstick formulations primarily for its fragrance, to mask the earthy scent of beetroot and other natural ingredients, and sometimes for its potential antioxidant properties.Vanilla essence, derived from *Vanilla planifolia* pods or produced synthetically as vanillin, is often incorporated into beetroot lipstick formulations primarily to impart a pleasant fragrance that masks the earthy odour of beetroot and other natural raw materials [20].

Table 01: Ingredientsfor prepation of Vanilla Essence

S.no	Ingredients	Uses
1.	Beetroot	Colouring agent
2.	Bees wax	Glossy and hardening agent
3.	Castor oil	Blending agent
4.	Coconut oil	Moisturizing agent
5.	Candelilla wax	Hardening agent
6.	Rose oil	Healing and soothing agent
7.	Olive oil	Hydrating agent
8.	Vanilla essence	Preserving agent Anti-oxidating agent Moisturizing and protecting agent
9.	Vitamin E oil	
10.	Vaseline	

Method

Extraction process

1. Beetroot Preparation

- **Washing and Peeling**: Fresh beetroot is thoroughly washed to remove dirt and then peeled to remove the outer skin.
- **Slicing:** The beetroot is cut into small, uniform slices or pieces.

2. Drying:

- **Shade Drying:**

The slices are spread on a surface like butter paper, covered with a fine mesh, and allowed to dry in the shade for a day.

- **Oven Drying:**

If necessary, any remaining moisture can be removed by drying the slices in an oven at a low temperature.

3. Grinding and Sieving

- **Grinding:** The dried beetroot is ground into a fine powder using a grinder.
- **Sieving:** The powder is passed through a fine sieve to remove any large or grainy particles, ensuring a smooth texture for the lipstick.

4. Extraction and Colour Development:

- **Powder as Pigment:**

The beetroot powder acts as the natural colorant in the lipstick formulation.

Table 02: Formulation Table of Natural Beetroot Lipstick (100 g)

S. No.	Ingredient	Function	Quantity (g)
1	Beetroot Powder	Natural colorant	5 g
2	Castor Oil	Gloss & smooth texture	20 g
3	Coconut Oil	Moisturizing agent	10 g
4	Olive Oil	Nourishment & glide	10 g
5	Beeswax	Thickener & base	20 g
6	Candelilla Wax	Vegan alternative / hardness	10 g
7	Vaseline	Emollient & texture enhancer	10 g
8	Vitamin E Oil	Antioxidant & preservative	2 g
9	Rose Oil	Fragrance & skin benefits	1 g
10	Vanilla Es-	Flavoring	2 g

	sence	agent	
	Total		100 g

Preparation of Lipstick Base

a) Melting the Waxes

- Combine beeswax and candelilla wax in a heat-resistant container.
- Melt the waxes using a double boiler or a heat-safe container placed in a pot of simmering water.

b) Alternatively, you can use a microwave, but be careful to heat in short intervals and stir frequently to prevent overheating

c) Adding Oils and Other Ingredients

- Once the waxes are melted, gradually add liquid oils like castor oil, coconut oil, and olive oil.
- Incorporate beetroot powder, ensuring they are evenly dispersed.
- Add other ingredients like rose oil, vitamin E oil, vanilla essence, and Vaseline are added for their benefits and fragrance.

d) Mixing and Cooling

- Thoroughly mix all ingredients until a homogenous mixture is achieved.
- If using pigments, ensure they are fully dispersed and don't settle at the bottom.
- Pour the melted mixture into lipstick molds or containers.
- Allow the mixture to cool and solidify completely before use.
- Adjust the ratio of waxes, oils, and pigments to achieve your desired lipstick properties.

e) Finishing

- **Removal:** Once solidified, the lipstick is removed from the molds.
- **Storage:** The lipstick is stored in a cool, dry place.

5. Packaging Beetroot Lipstick:

Packaging is crucial for beetroot lipstick, as it needs to protect the product while reflecting its natural and potentially sustainable qualities. Here are some common approaches and considerations:

a) Material and design:

- **Lipstick Tube**: Beetroot lipstick is often packaged in standard lipstick tubes, typically consisting of a base, a twisting mechanism, and a cap.
- **Materials:** Common choices include plastic (PET or PP for their lightweight nature and recyclability) and metal for durability and a high-end look. However, the trend is shifting towards eco-friendly alternatives like bio-based plastics and paper-based solutions.
- **Aesthetics:** A sleek, elegant design with branding elements (logo, colours) that reflect the natural and wholesome nature of beetroot lipstick can enhance consumerappeal.

b) Types of Packaging:

- **Primary Packaging:** This refers to the actual container holding the lipstick. Examples include the plastic or metal tubes mentioned above.
- **Secondary Packaging**: This is the external packaging that houses the primary container. Cardboard boxes are a popular choice for secondary packaging, offering space for branding, product information, and protection.
- **Alternative Options**: Other materials like bamboo packaging offer a natural and organic appearance and are gaining traction among sustainability-conscious consumers. Refillable packaging is another approach gaining momentum, as it significantly reduces waste by encouraging consumers to reuse containers.

c) Sustainable Packaging:

- **Eco-Friendly Materials**: Consider using recycled and renewable materials such as post-consumer recycled (PCR) plastics, paper, cardboard, bamboo, or even plant-based polymers like PLA.
- **Biodegradability:** Biodegradable options like paper-based tubes can help minimize environmental impact.
- **Minimalist Design**: Reducing unnecessary packaging and opting for a minimalist design can further decrease the environmental footprint.

d) Key Considerations:

- **Durability and Protection**: Packaging should be robust enough to protect the lipstick from physical damage, moisture, and light, especially given the natural ingredients in beetroot lipstick.
- **Hygiene and Safety**: The packaging should be safe and hygienic, particularly since lip products come into direct contact with the mouth.
- **Branding and Marketing**: The packaging is a vital tool for communicating the brand's message and attracting customers.
- **Regulatory Compliance**: Packaging needs to include necessary information like ingredients, warnings, net quantity, manufacturer details, and Period after Opening (PAO) symbols.
- **Evaluation Tests:**

Table 03: Evaluation Parameters of Natural Beetroot Lipstick:

S. No.	Parameter	Method/Observation	Result
1	Colour	Visual inspection	Reddish-pink
2	Texture	Touch and feel test	Smooth & creamy
3	Melting Point	Capillary method	60–65°C

4	pH	pH meter (1% dispersion in water)	5.5–6.5
5	Skin Irritation	Patch test on forearm	No irritation
6	Perfume Stability	Odour assessment over time	Stable fragrance
7	Surface Abnormalities	Visual check for cracks or spots	None observed

Evaluation of Herbal Lipstick

The formulated herbal lipstick was evaluated for different evaluation tests such as melting point, skin irritation, perfume stability, surface abnormalities, aging stability, solubility test, pH.

1. Organoleptic Properties

The formulated lipstick was evaluated for organoleptic properties such as colour, odour, and texture.

2. Solubility Test

The prepared herbal lipstick was dissolved in many solvents like acetone, hexane, petroleum ether, water, alcohol etc. and determine the solubility.

3. Melting Point

Melting point is determined to indicate the limit of safe storage. The melting point of prepared herbal lipstick was determined by capillary tube method. The melting point of lipstick was done by taking melted sample in a capillary tube and then capillary tube is subjected to the ice for 2hrs for cooling then capillary tube is tied to a thermometer. Then capillary tube was dipped into the beaker containing water which was subjected to continuous stirring. A temperature at which the sample starts to increase along with capillary tube it is considered as melting point.

4. Skin Irritation test

The prepared herbal lipstick formulations were studied for the skin irritation test. The skin irritation test done by applying the formulated herbal lipstick on the skin for 15 minutes and observe results.

5. Determination of pH

The pH of the prepared of herbal lipstick was determined by using pH meter.1 gram of lipstick was dissolved in 100 ml of distilled water and measure the pH.

6. Perfume stability

Perfume stability test done by storing the prepared lipstick at 40°c and periodically comparing, after bringing the temperature down; with the fresh lipstick.

7. Surface abnormalities

Surface abnormalities studied by the surface defects such as formation of crystals on surface, contamination by moulds, fungi etc. Formation of wrinkles, exudation of liquid substances and of solid fatty substances.

8. Aging stability

Aging stability test was done by product was stored in 40°c. And periodically observe of oil bleed , crystallization of wax on the surface.

Results

The herbal beetroot lipstick formulated using natural ingredients such as beetroot powder, beeswax, candelilla wax, rose oil, vitamin E, olive oil, Vaseline, coconut oil, and vanilla essence showed promising results in terms of aesthetic appeal, safety, and functionality. The formulation exhibited a uniform reddish-pink colour, smooth and creamy texture, and appropriate melting point and pH suitable for regular use. It was non-irritating, stable in fragrance, and free from any visible surface defects throughout the evaluation period. The formulated herbal lipstick was evaluated for various quality parameters to ensure its suitability for cosmetic use. On visual inspection, the lipstick exhibited an attractive reddish-pink color with a smooth and creamy texture, indicating good aesthetic appeal and ease of application. The melting point, determined by the capillary method, was found to be within the range of 60–65°C, confirming good thermal stability under normal storage conditions. The pH of a 1% dispersion in water was between 5.5 and 6.5, which falls within the skin-friendly range, ensuring compatibility with human lips. A skin irritation test, performed through patch application on the forearm, showed no irritation, indicating its dermatological safety. The perfume stability was assessed over time and found to be stable, maintaining its pleasant fragrance throughout the study period. Finally, surface examination revealed no cracks, sweating, or other abnormalities, confirming the overall stability and integrity of the formulation.

Discussions

The formulated herbal beetroot lipstick was found to possess desirable aesthetic and functional qualities, making it a potential alternative to conventional synthetic lipsticks. Synthetic lipsticks, although widely used, often contain petroleum derivatives, heavy metals, artificial colorants, and chemical preservatives that may cause adverse reactions such as lip darkening, dryness, allergies, or long-term systemic effects. Their high content of synthetic dyes like carmine, eosin, or coal tar derivatives has raised safety concerns among consumers.

In contrast, the herbal beetroot lipstick prepared in this study incorporated natural ingredients such as beetroot powder, beeswax, candelilla wax, olive oil, coconut oil, rose oil, and vitamin E, which not only provided a stable reddish-pink color but also delivered additional therapeutic benefits. The betalain pigments of beetroot offered a vibrant hue without harmful side effects, while oils and waxes contributed to miniaturization, nourishment, and improved texture. Unlike synthetic lipsticks, which may dry out the lips, the herbal formulation showed a smooth and creamy consistency that enhanced comfort during use. Evaluation results further supported these advantages. The lipstick demonstrated an acceptable melting point (60–65°C), a skin-compatible pH (5.5–6.5), stable fragrance, and no irritation on patch testing. Surface analysis also revealed the absence of cracks or abnormalities, re-

flecting good stability. These findings indicate that herbal beetroot lipstick is safe, non-toxic, and environmentally friendly, while still achieving performance comparable to or better than synthetic alternatives.

Therefore, while synthetic lipsticks dominate the cosmetic market due to their availability and wide shade range, the herbal beetroot lipstick represents a more sustainable and consumer-friendly option. Its natural composition meets the rising demand for chemical-free cosmetics and provides added skincare benefits, making it a promising substitute for synthetic formulations in both efficacy and safety.

Conclusion

The present study concludes that the herbal beetroot lipstick formulated with natural ingredients is a safer and more beneficial alternative to synthetic lipsticks. Unlike conventional formulations that rely on artificial dyes, petroleum derivatives, and chemical preservatives, the beetroot-based lipstick provided a natural reddish-pink colour, smooth texture, and stable fragrance without causing skin irritation. Its skin-friendly pH, moisturizing oils, and antioxidant properties further enhance lip health while minimizing side effects. The absence of harmful chemicals also makes it eco-friendly and suitable for long-term use. Overall, herbal beetroot lipstick not only matches the performance of synthetic lipsticks but also surpasses them in terms of safety, nourishment, and consumer acceptability, highlighting its potential as a sustainable cosmetic product for future applications.

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Conflicts of Interest

The authors declare no conflicts of interest.

Author Contribution

Both are contributed equally

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