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Design and characterization of a multipurpose herbal-based skin cream

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Abstract
Herbal cosmetics primarily consist of beauty products that are enriched with beneficial qualities, such as aiding skin recovery, improving texture, enhancing overall appearance, and conditioning the skin—all due to the power of herbal components. These items are formulated from plant-derived substances that provide genuine cosmetic advantages. When we mention phytoconstituents, we are talking about the pure compounds that have been extracted through various techniques. The aim of this project is to create and evaluate a multifunctional herbal cream derived from ingredients like tomato, honey, turmeric, aloe vera, and tulsi. The cream is formulated using a combination of beeswax, liquid paraffin, borax, methylparaben, distilled water, rose water, aloe vera gel, and dimethyl sulfoxide to harness the benefits of tulsi. We utilized trituration and fusion methods to ensure that all components and herbal extracts were blended thoroughly and uniformly. By employing these techniques, we produced three distinct versions of our herbal cream, designated as F1, F2, and F3. Each formulation was assessed based on a range of criteria, including appearance and pH. Each of the three formulations—F1, F2, and F3—showed great visual appeal, durability after washing, and ease of application, with no signs of separation present. They were all stable and safe for skin use, preserving the appropriate viscosity and showing no phase separation. Additionally, each formulation remained stable at ambient temperature.

Keywords: Cosmetics, herbal cream, tomato extract, honey, aloe–vera gel, turmeric extract, tulsi extract

Introduction

The demand for herbal cosmetics is increasing primarily due to the accessibility of herbal ingredients, as herbal formulations are becoming more favored among consumers because of their superior quality and fewer side effects [8]. Herbal creams, in particular, come in two main types: oil-in-water (o/w) emulsions and water-in-oil (w/o) emulsions. A cream is a semisolid emulsion that consists of either water dispersed in oil (w/o) or oil dispersed in water (o/w) and is meant for external application. It is applied to the outer layer of the skin, with the main function of adhering to the application site for longer durations. The goal of a skin cream is to protect the skin from various environmental elements and weather conditions while providing a soothing sensation. Creams are formulated using hydrophilic or hydrophobic bases, resulting in products that are largely compatible with the skin's natural secretions. Because they are produced using techniques developed in the pharmaceutical industry, creams are regarded as drug products; both unmedicated and medicated creams are widely used to treat a variety of skin conditions or dermatoses. They may be ayurvedic, herbal, or allopathic, with individuals selecting them according to their specific skin issues. Creams usually include one or several active components either dissolved or suspended within an appropriate base. Depending on their formulation, creams can be classified as either o/w or w/o emulsions. Traditionally, the word 'cream' has denoted semisolid mixtures formulated as either water-in-oil (such as cold cream) or oil-in-water (like vanishing cream).

Types of Skin Creams
They are classified into two types

1. **Oil-in-Water (O/W):** Creams that contain small droplets of oil distributed throughout a continuous phase are referred to as oil-in-water (O/W) emulsions, where the oil is dispersed in the aqueous phase as droplets.

2. **Water-in-Oil (W/O):** Creams contain minute oil droplets that are spread throughout a continuous phase, while an oil-in-water (O/W) emulsion is characterized by oil being distributed in the form of droplets within an aqueous phase [13].

Skin creams: Creams are emulsions that can either be classified as oil-in-water or water-in-oil types**.**

Based on the major ingredients and use of this formulation, they are broadly categorized as: -
Types of skin creams:

a. Make-up Creams (o/w emulsions).
b. E.g 1) Vanishing Creams. 2) Foundation Creams.
c. Cleansing creams (w/o emulsions).
d. Creams for winter (w/o emulsions).
e. E.g 1) Cold creams.
f. Creams for dry skin.
g. E.g 1) Moisturizing creams.
h. All-purpose creams.
i. Night creams.
j. Skin protective and hand creams [16].

Creams are thick or semi-solid mixtures that have a smooth texture and are designed for applying on the skin or certain

mucous membranes. They serve protective, therapeutic, or preventive roles, especially when you don't need an occlusive effect. These semi-solids mainly consist of solutions or suspensions that contain one or more active ingredients blended into suitable bases [23]. The goal of creating this versatile cream is to offer antiseptic benefits, boost skin radiance, provide hydration, reduce inflammation, combat pimples and acne, deliver antioxidant protection, and shield against sun damage. The cream is formulated with natural extracts, including:

1. Tomato extract, which acts as an antioxidant and helps protect against sun damage.
2. Honey, celebrated for its calming and hydrating qualities.
3. Turmeric, which serves as both an antiseptic and anti-inflammatory agent.
4. Aloe vera gel, recognized for its ability to reduce pimples and acne.
5. Tulsi, which promotes a glowing complexion and has antibacterial effects.
6. Additionally, the cream features natural bases that are pleasant to use, effective, easy to wash off, and completely safe for application.

Ideal Properties of the Cream

1. It is essential to keep the pH level suitable.
2. It must have the correct texture.
3. It should not feel tacky
4. It must be visually attractive.
5. It ought to be able to penetrate the skin's surface layer effectively.
6. It must be non-irritating and non-inflammatory.
7. It should deliver a silky sensation.

Advantages

- Skipping the first pass metabolism.
- Easy and convenient to use.
- Reducing risk.
- Issues related to intravenous therapy and various factors that affect absorption, like pH changes, the presence of enzymes, and how quickly the stomach empties.
- Achieving effectiveness with a lower overall daily medication dosage through continuous drug delivery [13, 16].

Disadvantages

- The drug and its excipients might lead to skin irritation due to contact dermatitis.
- Certain medications find it difficult to effectively penetrate the skin.
- There's a possibility of allergic reactions occurring.
- This approach is only suitable for drugs that require very low plasma concentrations to be effective.
- Enzymes present in the outer layer of the skin can alter the structure of medications.
- Drugs with larger particle sizes tend to be harder to absorb through the skin [16].

Materials and Methods

Collection of plant product: Tomato, Tulsi, Turmeric, Aloe-vera, and Honey were sourced and bought from a local market in Pune. Regardless of the category of the crude drugs and the region of collection, it is widely accepted that these substances are optimally gathered when they possess the highest concentration of active components. The benefits of the current environmental conditions are also factored in when harvesting natural drugs on a commercial level.

Methods for Cream Preparation

1. **Trituration method:** In this method when add insoluble powders or liquids, geometric dilution is used. A well is created in the center when pouring in liquids. To avoid air pockets, in large quantities of powder were grounded with mortor and pestle.

2. **Fusion method:** In the fusion method, medications and various solids are incorporated into a cream base and then mixed together. By heating the components within the base, the soluble elements are dissolved. After speculation or trituration, the solidified mixture is refined. Fusion employs specific techniques to guarantee that the base and additional ingredients are not harmed by thermal degradation [6].

Extraction Process

a. Preparation of Tomato extract

1. Start by measuring out 80-100ml of tomato puree.
2. Bring the puree to a boil for about 5-10 minutes, then let it cool down.
3. In a separating funnel, combine 7.5 ml of petroleum ether with the cooled tomato puree.
4. Next, add 5ml of methanol, 5ml of carbon tetrachloride, and a couple of drops of benzene into the funnel.
5. Give the funnel a good shake, then let the mixture sit so the lycopene layer can separate.
6. Once separated, boil the solution to extract the lycopene.

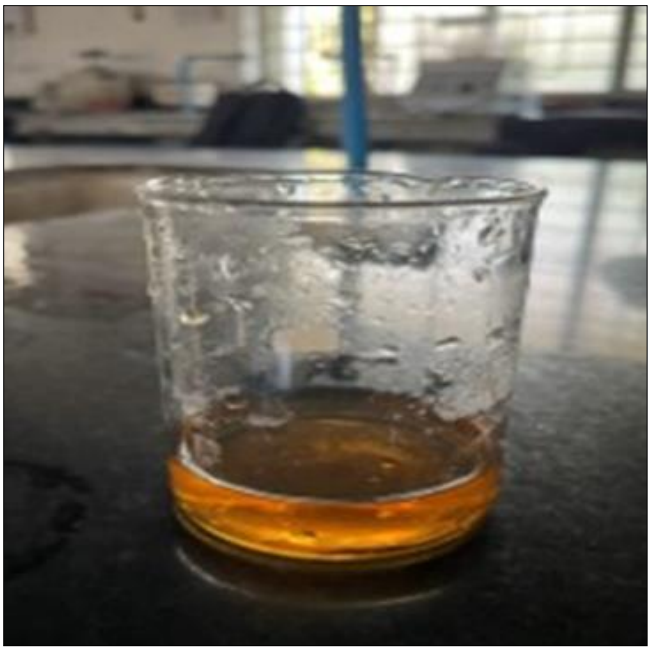

Fig 1: Tomato Extract

b. Preparation of Turmeric extract: To prepare the turmeric extract, take 1 gram of turmeric powder and mix it with 10 milliliters of distilled water. Shake this mixture in a 250-milliliter volumetric flask, and then heat it in a water bath at a temperature between 80°C and 100°C for about 5 to 10 minutes. After that, filter the mixture to obtain the turmeric extract [3].

Fig 2: Turmeric Extract

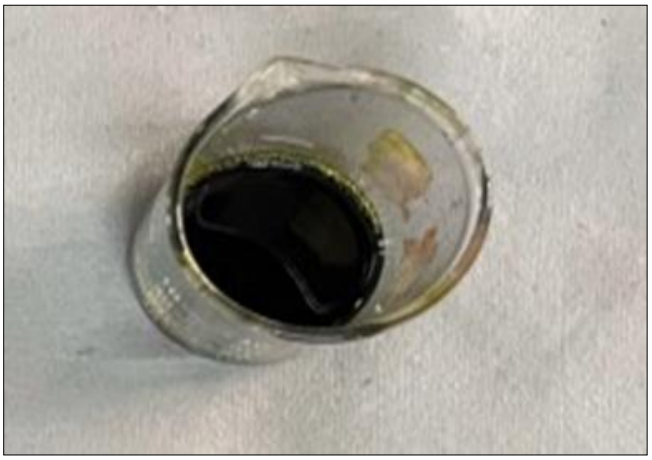

Fig 3: Tulsi Extract

c. Preparation of Tulsi extract: We started by collecting fresh Tulsi leaves, giving them a good wash with distilled water, and then drying them in a hot air oven. Once they were properly dried, ground the leaves into a fine powder. Subsequently, we combined 1 gram of Tulsi leaf powder with 10 ml of Dimethyl sulfoxide in a volumetric flask. Then heated this mixture in a water bath at a temperature between 80°C and 100°C for about 5 to 10 minutes. After that, we filtered the solution using filter paper to obtain a clear extract of the Tulsi leaves [17].

d. Aloe-vera gel extraction: Collect mature and fresh aloe-vera leaf from plant and washed it with distilled water. Leaf dissected longitudinally by sterile knife. The semi-solid aloe-vera is collected [6].

e. Honey: The marketed preparation of the honey is used directly.

Formulation Table

Table 1: Table of Ingredients and Their Functions

Sr. No	Ingredients	Formulation (F1)	Formulation (F2)	Formulation (F3)	Roles
1.	Tomato Extract	1.5ml	1ml	0.7ml	Antioxidant, Protection from sun damage.
2.	Turmeric Extract	1.3ml	1ml	0.5ml	Skin glow, antiseptic and anti-inflammatory.
3.	Tulsi Extract	1ml	0.5ml	0.3ml	Antibacterial, reduce redness, oil control.
4.	Aloe-vera gel	1.1gm	1gm	0.5gm	Wound healing, reduce acne and pimple.
5.	Honey	1ml	0.8ml	0.5ml	Moisturizing and soothing effect
6.	Beeswax	3.2gm	3.2gm	3.2gm	Emulsifying agent
7.	Borax	0.16gm	0.16gm	0.16gm	Emollient
8.	Liquid paraffin	10ml	10ml	10ml	Lubricating agent
9.	Methyl paraben	0.02gm	0.02gm	0.02gm	Preservative
10.	Water	Q.s for 20 gm	Q.s for 20 gm	Q.s for 20 gm	Diluent
11.	Rose water	Q.s for 20 gm	Q.s for 20 gm	Q.s for 20 gm	Fragrance

Procedure for Cream Preparation

1. **Gently heat the oil phase:** Begin by softly warming liquid paraffin and beeswax in a heat-resistant (borosilicate) glass beaker. Stir continuously until everything is melted and the temperature reaches approximately 75°C. This mixture will serve as your oil phase.

2. **Create the water phase:** In a different beaker, combine borax and methylparaben in distilled water. Heat this blend to the same temperature (75°C) to ensure that the ingredients dissolve completely, resulting in a clear solution. This will be your water phase.

3. **Merge the two phases:** Slowly incorporate the hot water phase into the oil phase while continuously stirring. This part is crucial for achieving a smooth mixture, so take your time and keep blending as you proceed.

4. **Incorporate herbal ingredients:** Now it's time to infuse your cream with beneficial additions! Blend the indicated quantities of tomato extract, turmeric extract, tulsi extract, aloe vera gel, and honey together. Continue stirring vigorously until everything is well-integrated and the mixture begins to develop a creamy consistency.

5. **Add a subtle fragrance:** To give a refreshing touch, include a few drops of rose water. It gives your cream a lovely natural fragrance.

6. **Final smoothing:** Pour the mixture into a mortar. If the cream seems a bit thick, incorporate a few drops of distilled water. Then, thoroughly grind it to ensure it's perfectly smooth and all ingredients are well combined [6].

Fig 4: F1, F2 and F3 Formulation

Evaluation tests for Cream

1. **Physical Parameters**: First, we took a good look at each cream—F1, F2, and F3—to assess their color, scent, texture, and overall appearance. This helped us get a first impression of each formulation.

2. **Washability:** Applied a small amount of each cream to our hands, let it sit for a bit, and then rinsed it off using plain tap water. This helped us see how easily the cream comes off and how it behaves with water.

3. **pH Test:** To check the skin-friendliness of each cream, we mixed 0.5 grams of cream into 50 ml of distilled water and used pH paper to measure the acidity or alkalinity. This is important to make sure the cream is gentle on the skin.

4. **Phase separation:** Stored each cream in a sealed container at room temperature, away from direct sunlight, and kept an eye on it for 24 hours to see if any ingredients started to separate. A stable cream should stay nice and uniform [3].

5. **Greasiness:** Applied a bit of each cream to the skin and then checked how it felt—was it light and smooth, or did it leave behind a greasy layer? This helped us evaluate how comfortable the cream would be for daily use.

6. **Spreadability:** A thin layer of cream is spread between two glass slides, and a weight is positioned on top. The distance of cream spreads is measured. Spreadability is assessed for all three formulations, which are F1, F2, and F3. The less time take for the separation of both the slide better the spreadability [1, 6].

$$\text{Spread ability(S)} = \frac{\text{Weight attached to the upper slide (W) x Length of the glass slide (L)g}}{\text{Time required to separate the slides (T)}}$$

7. **Irritancy test:** To make sure the cream is gentle on skin, we marked a 1 cm² patch on the back of the hand and applied the cream there. Over the next 24 hours, we watched for any signs of irritation like redness, itching, or rashes [3].

Result and Discussion

The developed multipurpose herbal cream demonstrated appealing physical qualities, such as a smooth texture, consistent formulation, and a pleasant scent. The cream has a light yellow-green colour, which generally falls within an acceptable visual range. Its pH level was measured between 6.1 and 6.8, suggesting it is appropriate for topical use. Stability tests conducted over a span of 60 days revealed no indications of phase separation. The spreadability tests showed that the cream was effortless to apply and could be evenly spread over the skin, while washability tests confirmed that it could be easily rinsed off with water without leaving any oily residue. Additionally, preliminary efficacy assessments showed positive outcomes, including enhanced skin hydration, decreased inflammation, and faster healing of minor injuries, affirming the cream's versatility for skincare. The analysis discusses the data in relation to the cream's formulation, effectiveness, and safety. It highlights the potential of the multipurpose herbal cream as a holistic skincare solution that addresses various skin concerns through natural and herbal ingredients. The discussion also examines the implications of these findings for the skincare industry, stressing the importance of botanical-based formulations and the increasing demand for multifunctional skincare products. Creating and assessing a multipurpose herbal skincare cream necessitates a thorough approach involving ingredient selection, formulation refinement, efficacy evaluation, safety review, market assessment, regulatory adherence, and continuous enhancements to effectively satisfy consumer requirements and preferences.

Observation Table

Table 2: Evaluation Test Parameters

Sr. No	Evaluation Parameters	Formulation (F1)	Formulation (F2)	Formulation (F3)
1.	Physical Parameters			
a)	Colour	Light yellow green	Light yellow green	Light yellow green
b)	Odour	Pleasant	Pleasant	Pleasant
c)	Texture	Smooth	Smooth	Smooth
d)	State	Semi-solid	Semi-solid	Semi-solid
2.	Washability Test	Easily washable	Easily washable	Easily washable
3.	pH Test	6.5	6.8	6.1
4.	Phase Separation	Slight phase separation	No phase separation	No phase separation
5.	Greasiness	Slightly greasy	Slightly greasy	Slightly greasy
6.	Spreadability (gm/sec)	Easily Spread	Easily Spread	Easily Spread
a)	Time	4-5 sec	3-4 sec	4-6 sec
7.	Irritancy	Nil	Nil	Nil

Conclusion

The cream showcased a remarkable multifunctional effect thanks to the blend of tomato extract, turmeric extract, tulsi extract, aloe vera gel, and honey. Each of these herbal ingredients brought its own unique and valuable properties to the table. From the results, we can confidently say that all three formulations—F1, F2, and F3—remained stable at room temperature and are safe for skin application. The F2 herbal cream formulation stands out in comparison to both F1 and F3. This research emphasizes the promising possibilities of using plant extracts in cosmetic applications. The personal care industry has seen a significant rise in the use of cosmetics lately. Incorporating bioactive components into these products not only influences the skin's biological processes but also provides essential nutrients for maintaining healthy skin. Throughout the testing phase, the cream demonstrated impressive consistency, excellent spreadability, and showed no signs of phase separation. The herbal cream's superior qualities and nutritional benefits were achieved with minimal chemical content, offering protection against various skin concerns. Plus, the cream is budget-friendly, thanks to its simple ingredients and easy preparation method. This herbal cosmetic formulation acts as a protective barrier for the skin and is safe for use. Results from various assessments of the cream suggest that it can be applied topically to shield the skin from damage. Natural remedies are becoming increasingly popular, as they are seen as less harmful and have fewer side effects compared to synthetic options. Further research will be carried out to scientifically validate the synergistic effects of this formulation.

Optimized Formulation F2

Table 3: Optimized Cream

Sr. No	Parameters	Results
1.	Colour	Light yellow green
2.	Odour	Pleasant
3.	Texture	Smooth
4.	State	Semisolid
5.	pH	6.5
6.	Washability	Easily washable
7.	Spreadability	Easily spread
8.	Phase separation	No phase separation
9.	Greasiness	Slightly greasy
10.	Irritancy	Nil

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