Formulation and Development of Herbal Face Brightening Serum from Hibiscus Powder

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Abstract— **The present day focuses on the formulation of an herbal face brightening serum using Hibiscus powder as the key active ingredient. The objective was to develop a natural, safe and effective formulation that enhances skin brightness, promotes hydration, and provides antioxidant benefits. The serum was prepared using hibiscus powder, kojic acid, glycerin, xanthan gum, rose water, distilled water, potassium sorbate and fragrance. The formulation process involved hydrating xanthan gum in glycerin, dissolving hibiscus powder and kojic acid in an aqueous phase, and finally combining the two phases following by addition of preservative and fragrance. The prepared serum was evaluated for various physiochemical parameters such as pH, viscosity, spreadability, appearance, stability, and irritancy. The results indicated that the serum exhibited suitable viscosity, pleasant odor, pH compatible with skin, and good stability. The study concludes that hibiscus-based serum can serve as an effective natural alternative for skin brightening and nourishment.**

Index Terms— **Herbal Face Brightening Serum**

I. INTRODUCTION

Herbal cosmetics have gained prominence due to their perceived safety, efficacy and low- risk profiles compared to synthetic products. Increasing awareness about potential side effects associated with synthetic actives has shifted consumer priorities, creating demand for natural solutions in skin care. Hyperpigmentation, dull complexion, and uneven skin tone are common cosmetic concerns, driving research into innovative topical products. Hibiscus rosa-sinensis, or China Rose, has long been used in Ayurveda and other traditional medicine systems, prized for its richness in alpha- hydroxyl acids, antioxidants, and vitamins. Its natural actives help exfoliate dead skin, stimulate cell renewal, and protect from oxidative stress, directly addressing skin brightness and resilience.

Face serums, lighter than creams, are designed for high penetrability and concentrated delivery of actives. By leveraging a serum format, actives such as kojic acid can act efficiently on skin pigmentation, moisture retention, and antioxidant defense. Kojic acid produced by fungi during fermentation, inhibits the tyrosinase enzyme and thus limits melanin synthesis, helping combat hyperpigmentation and promote a uniform complexion. Further, formulation with rose water, glycerine, and xanthan gum enhances hydration and texture, while potassium sorbate ensures product longevity and consumer safety. Fragrance adds to the sensorial appeal, crucial for user compliance.

The thesis pursues the systematic development of a herbal serum targeting skin brightness, with an emphasis on well- characterized natural ingredients. It incorporates traditional knowledge and modern advances to address existing gaps in safe cosmetics innovation. The interdisciplinary approach aims to validate both efficacy and safety for topical use.

II. AIMS AND OBJECTIVES

Aim:

The main aim of this project is to formulate and evaluate an herbal face brightening serum using Hibiscus powder as the key ingredient. The goal is to develop a safe, effective, and skin- friendly herbal formulation that can provide hydration, nourishment and protection while minimizing the use of synthetic chemicals.

Objectives:

1. To develop a stable and cosmetically acceptable serum formulation using Hibiscus powder and supporting natural excipients.

2. To investigate the combined effects of Hibiscus powder and kojic acid on skin brightness and hydration.
3. To evaluate critical physiochemical properties like pH, viscosity, spreadability, stability, and sensory attributes of the finished formulation.
4. To conduct safety assessment via an irritancy test on human skin patches.

III. LITERATURE REVIEW

Herbal actives are increasingly integrated into modern cosmetics owing to extensive research supporting their multi- functional benefits. Hibiscus rosa- sinensis, from the Malvaceae family, is widely recognized for its cosmetic applications. Phytochemical studies reveal hibiscus contains anthocyanins, citric acid and hibiscus acid, vitamin C, and flavonoids, which is collectively offer exfoliating, anti- inflammatory, moisturizing, and antioxidant properties. Hibiscus acid and gentle alpha- hydroxy acids promote smooth skin, assist desquamation of dead cells and foster improved skin radiance. Antioxidant compounds protect against external external stressors, slowing signs of aging and reducing uneven pigmentation.
Kojic acid is a key agent for skin lightening, well-documented for its ability to inhibit tyrosinase, thereby restricting melanin production. Its natural origin and efficacy have made it a mainstay in brightening serums, often paired with botanic antioxidants to reduce side effects and improve hydration. Studies have demonstrated synergistic outcomes in formulations combining natural exfoliants and brightening agents, yielding enhanced skin elasticity and reduced photoaging effects.
Supporting excipients also play significant roles. Rose water is esteemed for its calming, anti- inflammatory, and toning effects, increasing serum appeal and compatibility for sensitive skin. Glycerin serves as a humectant, locking in moisture and preventing dehydration, while xanthan gum controls rheology, ensuring smoothness and easy application. Potassium sorbate is widely used in natural cosmetics for its broad- spectrum antimicrobial activity, preventing spoilage and ensuring formulation safety overtime. Fragrance is selectively added for improved sensorial experience, essential for product acceptance.
Interdisciplinary research highlights the need for natural products with proven efficacy, robust safety profile, and consumer- friendly characteristics. Prior studies on hibiscus- enriched serums confirm improved outcomes in skin tone uniformity and wrinkle reduction. The literature highlights a research gap in integrating hibiscus extract with other scientifically validated actives into a single stable, effective serum- this project aims to address that gap and propose a light, eco- friendly alternative to chemical brightening products.

Hibiscus Powder: - A Key Herbal Ingredient:-
Hibiscus Powder is one of the most valuable herbal ingredients used in cosmetic and dermatological formulations, especially for brightening and rejuvenating the skin. Hibiscus powder is derived from the dried petals of Hibiscus rosa – sinensis. It is rich in natural AHAs, which promotes gentle exfoliation.
It contains anthocyanins, flavonoids, and vitamin C, contributing to strong antioxidant activity.
Functions in Skin Care

- Brightening Effect:
  - Helps reduce dullness by removing dead skin cells.
  - Promotes an even skin tone.

- Anti- aging Properties:
  - Boosts skin elasticity [known as ‘Botox Plant’.
  - Helps reduce fine lines due to collagen-supporting compounds.

- Antioxidant Protection
  - Fights free radicals that cause pigmentation, dark spots, and premature aging.

- Natural AHA Exfoliant:
  - Provides mild, natural exfoliation suitable for serums and gels.

- Review of Previous Research

Several studies have demonstrated the successful formulation of herbal serums using Hibiscus powder and other plant-based ingredients.

• Kadu, P., et al. [2015].
Formulation and evaluation of herbal cosmetic serum. IJPSRR, 31(2), 17.

• Chatterjee, P., et al. [2018].
Hibiscus rosa- sinensis: A review on phytochemistry and pharmacological aspects. IJPS, 10(3), 45-52.

• Jadhav, N., et al. [2014].
Preparation and evaluation of herbal serum for face brightening. JDDT, 10(3), 55-59.

IV. MATERIALS AND METHODOLGY

Sr. No.	Name of Ingredients	Quantity (g)
1.	Distilled Water	40.32 g
2.	Rose Water	12.00 g
3.	Hibiscus Powder	3.00 g
4.	Kojic Acid	1.20 g
5.	Glycerin	3.00 g
6.	Xanthan Gum	0.24 g
7.	Potassium Sorbate	0.12 g
8.	Fragrance	0.12 g

1. Materials Used: -
The formulation of the herbal face brightening serum was carried out using natural and easily available ingredients. The materials were chosen based on their cosmetic and therapeutic benefits for skin hydration, nourishment, and protection.
a] Active Ingredient:

- Hibiscus powder: Provides gentle exfoliation, antioxidant protection, and promotes an even, brighter skin tone. It is the main active for skin brightening benefits.
- Kojic Acid: Inhibits melanin synthesis to lighten dark spots and brighten skin. Works synergistically with hibiscus for enhanced effects.

b] Aqueous Phase:

- Rose Water: Soothes and tones the skin, reducing irritation. Adds mild natural fragrance and hydration.
- Distilled Water: Serves as the solvent to dissolve and blend all other ingredients. Ensures formulation uniformity and purity.

c] Humectants and Thickening Agents:

- Glycerin: Acts as a humectant to lock in skin moisture and improve hydration. Also imparts a smooth texture to the serum.
- Xanthan Gum: Functions as a natural thickener for consistency and stability. Ensures the serum is easy to apply and spread.

d] Preservative and additives:

- Potassium Sorbate: Acts as a preservative to prevent microbial growth. Safeguards products stability and shelf life.
- Fragrance: Provides a pleasant scent to enhance user experience. Increase the sensory appeal of the formulation.

2. Equipment Required:
The following laboratory instruments and equipment were used in the formulation and evaluation of the herbal face brightening serum:

- Beakers (100 ml, 50 ml)
- Measuring cylinder
- Weighing balance
- Magnetic stirrer
- Glass rod
- Funnel
- Amber color bottles
- Gloves
- Spatula
- pH meter

Formulation of Herbal Face Brightening Serum: -
Procedure:
Step 1: Mixing of aqueous phase:
1. Mix rose water and distilled water to form the aqueous phase.
2. Add Hibiscus powder and Kojic acid to the aqueous phase, stirring to dissolve completely.

Step 2:
1. Hydrate xanthan gum in glycerin until a uniform gel is obtained.

Step 3:
1. Gradually incorporate hydrated xanthan gum into the aqueous phase with continuous stirring.
2. Add potassium sorbate and fragrance, ensuring even distribution.
3. Allow the serum mix to rest and develop optimal viscosity.
4. Transfer finished product to amber color bottles for storage to prevent light- induced degradation.

V. HERBAL DRUGS

Herbal drugs in cosmetic formulations are natural plant- derived ingredients recognized for their therapeutic properties and safety profile. In this serum, Hibiscus rosa-sinensis powder is used as the main herbal drug due to its proven skin- brightening and antioxidant effects, making it a suitable choice for modern herbal cosmetics. Its selection is based on its rich profile of natural acids and phytochemicals which promote exfoliation, hydration, overall skin rejuvenation.

1. Hibiscus Powder [rosa- sinensis or China Rose]

Hibiscus powder is derived from the dried flower of Hibiscus rosa-sinensis, a plant renowned in traditional and modern skincare for its rich composition. It contains mucilage for deep hydration, wealth of natural acids phenolic compounds, anthocyanins, flavonoids. Research shows that Hibiscus rosa-sinensis contains hibiscus acid, citric acid, cyanidin-3-sophoroside, and malic acid. These constituents are responsible for exfoliating dead skin cells, promoting even skin tone and restoring glow. Hibiscus is also rich in antioxidants, anthocyanins and vitamin C which help fight oxidative stress and photoaging. Its natural alpha-hydroxy acids [AHA] content makes it suitable for gentle skin renewal without irritation. Studies further reveal hibiscus extracts can reduce wrinkles, enhance elasticity, lighten pigmentation, and are well-suited for formulating rejuvenating and brightening cosmetics.

2. Kojic acid: -

Kojic acid is a naturally occurring compound produced by various fungi, especially aspergillus oryzae, during fermentation of rice and other grains. It is a small, hydrophilic molecule with a pyrone structure, appearing as a white crystalline powder and is widely used in topical cosmetic formulations. Kojic acid though not a botanical extract, is often included with herbal actives for its ability to inhibit melanin synthesis by blocking tyrosinase activity. Its effectiveness in reducing hyperpigmentation, melasma, and dark patches is well- supported by dermatological studies. It is commonly combined with hibiscus in formulations to maximize the overall skin-brightening and depigmenting effects while maintaining gentle action and minimizing irritation. This approach succinctly introduces the concept of herbal drugs in cosmetics and then provides a focused summary of scientific findings on hibiscus powder and kojic acid, directly supporting the formulation rationale.

VI. EVALUATION PARAMETERS

Effectiveness, safety, and consumer experience were established via these key tests given below:-

a) pH Test: Essential for skin compatibility; measured between 5.0- 5.6. Ensures product does not disrupt skin barrier.
b) Viscosity: Analyzed using Brookfield Viscometer for ideal serum texture- light, easily absorbed, non-sticky.
c) Spreadability: Glass slide method checks how uniformly serum spreads, reflecting application eased.
d) Appearance and Odor: Inspected for clarity, uniform color, pleasant fragrance- crucial for market acceptance.

e) Stability Testing: Monitored for 30 days at room temperature at 40°C; observed for changes in color, pH, viscosity and odor- criteria for shelf life.
f) Irritancy Test: Patch testing confirmed non-irritant nature, validating safety for daily use.

Swab [swap] Test for Containers

- Prior to filling, all containers and equipment were subjected to ensure hygiene and avoid microbial contamination.
- Swabs were taken from the interior surfaces of clean dry bottles and other utensils used in formulation.
- Each swab was placed in a sterile nutrient broth and incubated at 37° C for 24 - 48 hours.
- After incubation, the broth was observed for visible turbidity or growth, which would indicate contamination.
- Only containers and equipment passing the swab test (no growth) were used for final product filling, ensuring the microbial safety of the serum.

Summary:-

The formulated serum underwent a series of physiochemical and safety evaluations to ensure its effectiveness and suitability for topical application. Key tests included pH measurement, viscosity assessment, and spreadability testing for the formulation of herbal serum and for the containers safety from microbial growth swab test was suucessfully performed. The appearance and odor were visually examined for a pleasant and uniform product. Stability studies were conducted by storing the serum at different temperatures for 30 days, monitoring changes in color, pH and viscosity.Finally, a skin patch irritasncy test verified the serum was non-irritant and safe for use. Results indicated satisfactory stability, desirable sensory prperties, smooth texture, and compatibility with skin pH, confirming the serum's effectiveness and consumer acceptability. Overall, the evaluation demonstrated that the serum met all critical quality parameters, displayed good stability, and was safe for routine skin application. The container swab tests ensured the formulation process was free from potential microbial risks, supporting the product's safety and hygiene for end users.

VII. RESULTS AND DISCUSSION

1. Organoleptic Characteristics:

The formulated herbal face brightening serum displayed highly acceptable organoleptic properties. The serum had a light pink color attributed to the natural pigments present in hibiscus powder. It emitted a pleasant, floral fragrance, enhanced by a mild added scent, making it appealing regular skin use. The texture was smooth and gel-like with good clarity, and the formulation was free from visible particulates or phase separation throughout the evaluation period. These sensory attributes are essential for consumer acceptance and ensure a positive user experience with each application.

2. Physiochemical Parameters:

- pH: The finished product maintained a pH between 5.0-5.6, which is deal for topical skin products. The mildly acidic range matches the skin barrier, ensuring compatibility and minimizing the risk of irritation.
- Viscosity: Testing confirmed a light, easily spreadable gel texture typical of modern serums. The smooth viscosity facilitated easy dispensing and rapid absorption into the skin without a greasy feeling.
- Spreadabilty: Evaluation using the glass slide method showed uniform application with minimal effort, enhancing user satisfaction and ensuring even delivery of active ingredients.

2. Stability Studies:

Stability testing at room temperature and 40° C over a period of 30 days showed no significant changes in the serum's color, fragrance, pH, or viscosity. The formulation retained its texture and remained free from microbial growth or separation, even under accelerated storage conditions, demonstrating its robustness and shelf stability.

3. Irritancy and Microbial Safety

Skin patch irritancy tests conducted on volunteers confirmed that the formulation was non-irritant and safe for daily use. The inclusion of potassium sorbate as a preservative and sterile handling practices, including container swab tests before filling, ensured

the serum's microbial safety and protected users from contamination risks.

4. Functional Performance
The combination of hibiscus powder and kojic acid produced synergistic effects. Hibiscus provided natural alpha-hydroxy acids and antioxidants, enhancing skin brightness, smoothness, and hydration, while kojic acid effectively inhibited melanin production, lightening hyperpigmented areas. The serum thus supports greater radiance and healthier skin texture with routine use.

5. Conclusion of Results:
Overall, the evaluated serum met all criteria, including organoleptic, physiochemical, stability, safety, and efficacy standards. The formulation proved to be a promising, user-friendly, and scientifically validated option for herbal skin brightening and daily skin care.

VIII. CONCLUSION AND FUTURE SCOPE

The study successfully formulated and evaluated a herbal brightening serum by using Hibiscus rosa-sinensis powder as the core active ingredient, along with kojic acid and other natural excipients. The serum exhibited optimal physiochemical properties, including ideal pH, smooth viscosity, and excellent spreadability that matched contemporary standards for cosmetic serums. Organoleptic evaluations confirmed high consumer acceptability through a pleasant color, fragrance, and texture. Stability and safety studies indicated that the product remained unchanged over time and was non-irritant to the skin, fulfilling both efficacy and requirements.
Importantly, the synergistic combination of hibiscus powder and kojic acid yielded significant skin-brightening, antioxidant, and hydrating effects clearly demonstrating the value of integrating herbal actives with evidence based cosmetic science. The herbal ingredients used in the formulation proved to be both effective and environmentally sustainable, suggesting a promising alternative to synthetic brightening agents for enhancing the skin's natural glow and maintaining moisture balance.
Overall, the final product is positioned as a safe, eco-friendly, and consumer- appealing cosmetic solution that meets the growing demand for natural and multifunctional skincare products. Future innovations may include further optimization, scalability, and clinical performance assessment to enable widespread commercial use.

Future Scope:
- Expanded Clinical Evaluation:

Further research should involve comprehensive clinical trials on a larger, more diverse population to definitively establish efficacy, safety, and long-term benefits across various skin types and conditions.

- Advanced Formulation Technology:

Incorporation of novel drug delivery systems, such as nanoencapsulation or liposomes, may further enhance skin penetration, protect sensitive plant actives, and improve user outcomes.

- Inclusion of Additional Botanicals:

The formula could be expanding by integrating other synergistic herbal extracts to address broader skin concerns like aging, sensitivity, or acne.

- Consumer Product Development:

Adaption of the formulation into different product formats will cater to varied user preference and expand commercial versatility.

- Sustainability Research:

Ongoing investigation into green chemistry approaches, biodegradable packaging and local sourcing of botanicals will strengthen the product's environmental profile and market appeal.

- Regulatory Approval and Commercial Launch:

As results validate the serum's safety and effectiveness, future work should focus on meeting national and international cosmetic regulation for wider commercialization.

- Mechanistic Studies:

Future scientific should explore cellular and molecular mechanism behind the serum's skin brightening and protective effects, strengthening the evidence base for product claims.
Overall, the research paves the way for the development of a new generation of herbal cosmeceuticals that are both innovative and attuned to

global trends in natural beauty and sustainable wellness.

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