

FORMULATION AND EVALUATION OF LUMINOUS BLEND HERBAL CREAM OF COFFEA ARABICA AND SOLANUM TUBEROSUM FOR SKIN LIGHTENING

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Abstract

Cosmetic products increasingly utilize herbal plants to mitigate the adverse effects of ultraviolet (UV) radiation on the skin, which can cause sunburns, wrinkles, tans, and skin cancer by stimulating melanin production. The cosmetic industry, in pursuit of brighter skin tones, favours natural plant-based ingredients for their efficacy and minimal side effects. Coffea Arabica, known for its bioactive compounds like caffeine and chlorogenic acid, offers protective and skin-enhancing benefits. Caffeine shields the skin from UV rays and improves complexion by constricting blood vessels, while chlorogenic acid acts as an antioxidant. This study formulated a herbal skin lightening cream using Coffea Arabica powder and raw Solanum tuberosum juice, supplemented with coconut and olive oils. Solanum tuberosum, containing azelaic acid, inhibits tyrosinase enzyme activity, reducing pigmentation and dark spots. Six formulations were prepared. The formulation process involved preparing oil-in-water emulsions and incorporating stabilizers like benzyl alcohol and citrus lemon juice to maintain the stability of Solanum tuberosum juice. Evaluations included physical appearance, extrudability, spreadability, pH, viscosity, centrifugation, freeze-thaw cycles, sun exposure, and antimicrobial activity. This study demonstrates the combined skin benefits of Solanum tuberosum juice and Coffea Arabica, offering a scientifically grounded, herbal approach to skincare.

Keywords:

Herbal skin lightening, Coffea Arabica, Solanum tuberosum, UV protection, natural cosmetics, skin brightening, antioxidants

Introduction:

The skin, the body's largest organ, is composed of water, proteins, fats, and minerals. It consists of three tissue layers: the epidermis (top layer), dermis (middle layer), and hypodermis (bottom or fatty layer). [1] The epidermis is the outermost and visible layer. We often spend a lot of time and effort trying to make this layer look as good as possible with products and treatments. But the epidermis' most important job isn't aesthetic-it's to protect the body from the environmental harms such as the sun, pollutants and other potential skin irritants. It produces new skin cells and also contains pigment, which gives your skin its colour. Issues such as hyperpigmentation and acne scars are also visible in this layer. Soy products can brighten hyperpigmented areas, and salicylic acid helps clear pores of excess oil and pollutants, reducing acne. Most skincare products, including sunscreens, target the epidermis. This layer also houses the skin barrier, which prevents water and nutrient loss. Moisturizers nourish this layer and retain moisture. When the skin barrier is compromised, it can lead to issues such as dullness, flakiness, redness, and itching. [2]

Skin lightening products also known as bleaching creams, whiteners, skin brighteners, or fading creams work by reducing a pigment called melanin in the skin. Most people who use lighteners do so to treat skin problems such as age spots, acne scars, or discoloration related to hormones. It is also a technique used to lighten naturally dark skin. [3] Skin colour is determined by the amount of melanin in the skin. Melanin is a pigment produced by specialized cells called melanocytes. People with dark skin have more melanin. [4] Sunlight exposure, hormones, skin damage, and exposure to certain chemicals can also affect melanin production. [3] Changes in skin colour will often resolve themselves. For instance, tans fade when the amount of direct exposure to sunlight is reduced. But over time, certain discolorations, such as "age" spots or "liver" spots, become more or less permanent. [5]

Skin bleaching is a cosmetic treatment to reduce the prominence of skin discolorations and even out the colour of the skin. [6] Some people apply skin lightener to their entire body to change their complexion, but this can be very risky. The active ingredient in some skin lighteners is mercury, so bleaching can lead to mercury poisoning. Mercury is a toxic agent that can cause serious psychiatric, neurological, and kidney problems. [7] Pregnant women who use a skin lightener with mercury can pass the mercury to their unborn child. [8] Skin lighteners contain an active ingredient or a combination of ingredients that reduces the amount of melanin in the skin where it is applied. [3]

Cosmetic advancements, driven by the desire to enhance human aesthetics, increasingly harness the potential of herbal plants to counteract the detrimental impact of prolonged exposure to ultraviolet (UV) radiation on the skin. [9] The detrimental effects of UV rays, including sunburns, wrinkles, tans, and the risk of skin cancer, stem from their ability to penetrate the epidermal layers, triggering melanocytes to produce melanin. [10] Seeking solutions for a radiant complexion, the cosmetic industry is turning to natural plants for their inherent functional properties and minimal side effects. [11] A prime example is *Coffea Arabica*, a member of the Rubiaceae family, celebrated for its rich array of bioactive compounds, notably caffeine and chlorogenic acid. Caffeine not only acts as a shield against UV radiation but also imparts a rejuvenating effect by constricting blood vessels, resulting in smoother and brighter skin. Concurrently, chlorogenic acid emerges as a stalwart antioxidant, combatting free radicals. [12] The strategic combination of *Coffea Arabica* powder and raw *Solanum tuberosum* juice augments the synergistic benefits. *Solanum tuberosum*, hailing from the Solanaceae family, stands out as a natural skin bleaching agent, courtesy of azelaic acid, which inhibits tyrosinase enzyme activity. This inhibition leads to a reduction in dark spots, pigmentation, and melanin synthesis, ultimately contributing to a lighter skin tone. [13] Within this innovative cosmetic formulation, the inclusion of olive oil and coconut oil adds an extra layer of efficacy, emphasizing a holistic approach to skincare. This amalgamation of natural elements underscores a fusion of scientific insight and traditional wisdom, portraying a nuanced understanding of skincare dynamics. [14]

Materials and methods:

Materials

Coffea arabica powder was taken from the Reliable Laboratory and the potatoes and lemons were brought from the local market. Six formulations of Coffea Arabica powder and raw Solanum tuberosum juice were prepared as skin lightening cream.

Methods

Stabilization of Solanum tuberosum juice:

Solanum tuberosum juice was not stable at room temperature so we had added different types of preservatives and stabilizers to stabilise Solanum tuberosum juice.

Stabilization of potato juice was done by adding different preservatives.

- 1) Solanum tuberosum juice + Citrus lemon juice
- 2) Solanum tuberosum juice + Benzyl alcohol (1%)
- 3) Solanum tuberosum juice + Benzyl alcohol (1%) + Citrus lemon juice
- 4) Solanum tuberosum juice [15]

The sample containing Solanum tuberosum juice, benzyl alcohol and Citrus lemon juice was found to be stable by visual observation for 60 days.

Formulation of herbal cream

Six formulations of the caffeine powder with raw solanum tuberosum juice were prepared as skin lightening cream. They were oil in water emulsions. The following are the steps followed for preparation of the cream:

- 1) The emulsifier and other oil soluble components (i.e. stearic acid, cetyl alcohol, sodium lauryl sulphate i.e. SLS, olive oil and coconut oil) were dissolved in oil phase.
- 2) Firstly stearic acid, cetyl alcohol and SLS were heated up to 70°C on water bath. Then the olive oil and coconut oil were added in it.
- 3) The caffeine powder was dissolved in distilled water with addition of raw Solanum tuberosum juice and preservative i.e. benzyl alcohol. Then, lemon juice was added in it with a separate beaker. This aqueous mixture was then warmed at 70°C.
- 4) After gaining same temperatures, the oil phase was added to the aqueous phase with constant stirring under room temperature.
- 5) Perfume was added when the temperature dropped to 30°C ± 40°C.
- 6) The cream was stirred continuously until cooling of emulsifier and homogeneity of cream took place.
- 7) Then the prepared cream was stored in a closed container.

Evaluation parameters

- 1) Appearance: All the 6 batches of herbal cream are tested for appearance by visual observation.
- 2) Odour: The Herbal cream was found to be in pleasant odour.
- 3) Extrudability: Extrudability test is useful empirical test to measure the force which is required to extrude the material from a tube.
- 4) Spread ability: The Spreadability of the cream was evaluated by spreading or applying the prepared cream on the skin surface.
- 5) Determination of pH: The pH of herbal cream was determine with the help of pH meter. The measurements were performed at 1, 30, 60, 90 days after preparation to detect any pH changes with time.
- 6) Homogeneity test: All creams were tested for physical homogeneity by visual observation.
- 7) Sun exposure evaluation: In the sun exposure evaluation, the cream was placed under sun light for 24 hours and the changes were observed visually.
- 8) Viscosity: The viscosity of the prepared cream was carried out by Brookfield viscometer. The readings were taken at 100 rpm using spindle no.6.
- 9) UV spectrophotometric analysis of the Coffea arabica powder: The required powder was dissolved in ethanol and its dilutions were made with ethanol to test the presence of the active ingredient in the taken powder.
- 10) Centrifugation testing: For centrifugation testing all 6 batches of cream are placed in centrifugation testing apparatus and the separation of two phases was observed.
- 11) Freeze thaw test: In freeze thaw testing, prepared creams was placed in freeze at low temperature and then cream was placed at room temperature. This cycle was repeated for 5 times and changes were observed by visual observation.
- 12) Stability study of herbal cream: The stability study was performed as per ICH guidelines. The formulated herbal cream was packed in well closed containers and stored at different temperatures and humidity

conditions, for period of 3 months. Samples were taken after 3 months and evaluated for appearance, pH, viscosity.

Results and Discussions:

The prepared cream formulation was assessed for various evaluation parameters, including spreadability and homogeneity. The pH of the cream was found to be between 6.5-7, indicating it is a homogenous mixture with excellent spreadability. All the study shows that all 6 creams are stable for 3 months but all the formulations are showing some deviations in parameters but it was not too much so it was acceptable. After all evaluations, one of the formulation was determined to be the optimized.

Conclusion

A herbal skin lightening cream was formulated using Coffea arabica and Solanum tuberosum juice, with coconut and olive oil as the base. Among six different batches, it was concluded that the F4 batch, which contained 8 ml of olive oil and 20 ml of Solanum tuberosum juice, was identified as the optimal formulation after thorough evaluation. This study indicates that the combination of Solanum tuberosum juice and Coffea arabica provides enhanced skin benefits. Additionally, the F4 batch demonstrated stability over a period of three months.

SR.NO.	INGREDIENTS	FOR 100 GM						USES
		F1	F2	F3	F4	F5	F6	
1.	Solanum Tuberosum raw juice	40 ml	30 ml	30 ml	20 ml	40 ml	25 ml	Bleaching agent
2.	Caffeine powder	1%	1%	1%	1%	1%	1%	Toner
3.	Lemon juice	-	10 ml	10 ml	20 ml	-	15 ml	Exfoliator
4.	Stearic acid	10 ml	10 ml	10 ml	10 ml	10 ml	10 ml	Emulsifier
5.	Cetyl alcohol	5 ml	3 ml	4 ml	3 ml	2 ml	2 ml	Emollient
6.	Olive oil	5 ml	7 ml	7 ml	8 ml	5 ml	6 ml	Moisturizer
7.	Coconut oil	8 ml	10 ml	10 ml	8 ml	8 ml	8 ml	Humectant
8.	Benzyl alcohol	1.5 ml	1.5 ml	1.5 ml	1.5 ml	1.5 ml	1.5 ml	Preservative
9.	Sodim lauryl sulphate	10 ml	5 ml	10 ml	10 ml	5 ml	10 ml	Wetting agent
10.	Distilled water	Qs	Qs	Qs	Qs	Qs	Qs	Vehicle

TABLES

Table No.1: Formulation Table

PARAMETERS	FORMULATION					
	F1	F2	F3	F4	F5	F6
COLOUR	Off white	Off white	Off white	Off white	Off white	Off white
VISUAL APPEARANCE	Constancy is very thin	Constancy is slightly hard	Constancy is slightly hard	Smooth and constituent cream	Smooth and constituent cream	Constancy is slightly hard
FOREIGN PARTICELS	Free from foreign particles	Free from foreign particles	Free from foreign particles	Free from foreign particles	Free from foreign particles	Free from foreign particles
ODOUR	Pleasant odour	Pleasant odour	Pleasant odour	Pleasant odour	Pleasant odour	Pleasant odour
EXTRUDABILITY	Good	Good	Good	Good	Good	Good
SPREDABILITY	Very easily spreadable	Slightly hard to spread	Slightly hard to spread	Easily spreadable	Easily spreadable	Easily spreadable
pH	6.9	6.8	6.8	6.7	6.9	6.7
Sun exposure test	Pass	Pass	Pass	Pass	Pass	Pass
Viscosity	3800	3700	3650	3900	3800	3500
Centrifugation test	Pass	Pass	Pass	Pass	Pass	Pass
Freeze thaw test	Pass	Pass	Pass	Pass	Pass	Pass

Table No.2: Results of evaluation tests on prepared herbal skin lightening cream

FIGURES

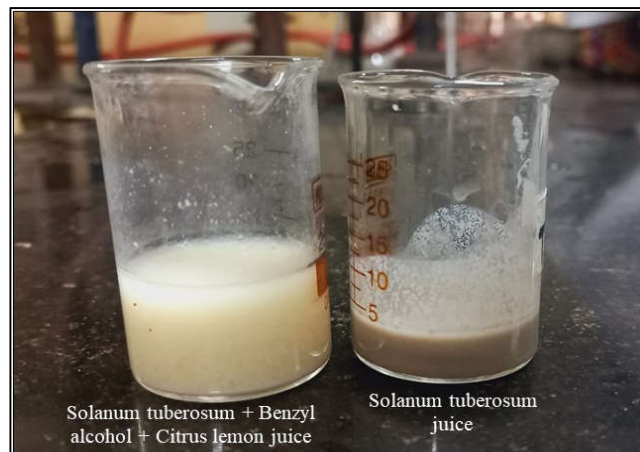


Figure No.1: Day 60 of stabilizing Solanum tuberosum juice with different stabilizers



Figure No.2: Ingredients required for formulating the herbal cream



Figure No.3: Mixing the oil phase in aqueous phase



Figure No.4: Six formulations of prepared herbal cream with their respective pH papers

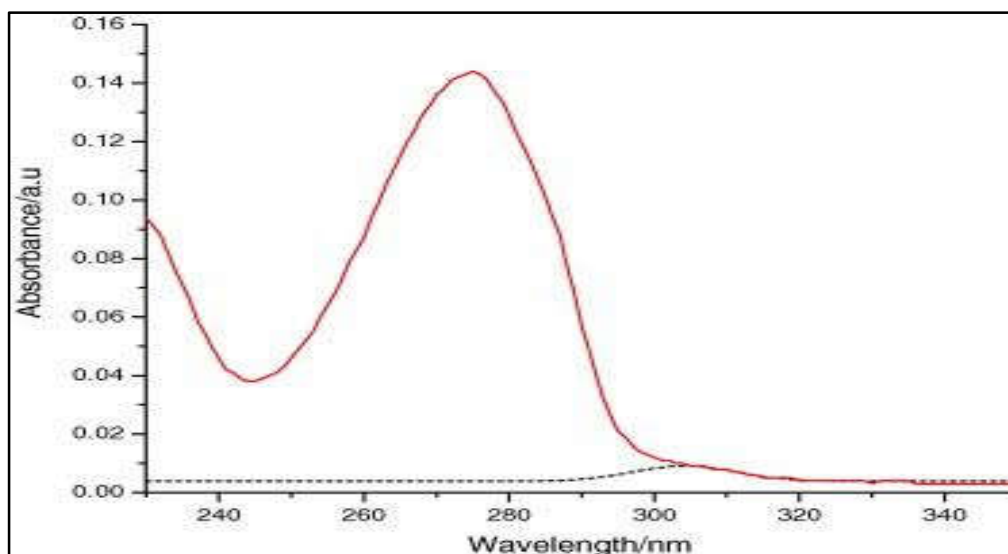


Figure No.5: UV Spectrophotometric analysis of Coffea arabica powder extract – Caffeine λ_{max} was found to be 277 which was approximately equal to the standard i.e. 279



Figure No.6: Optimized formulation (F4) of herbal skin lightening cream of Coffea arabica and Solanum tuberosum juice

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