

Formulation and Evaluation of Herbal Exfoliating Liquid Crystal Cream from Myrciaria Dubia

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ABSTRACT

This study aims to formulate and evaluate a Herbal Exfoliating Liquid Crystal Cream combining natural exfoliants with liquid crystal technology for enhanced skin care benefits. The cream was prepared using jojoba oil, caprylic/capric triglyceride, soya lecithin, glycerine, and selected herbal extracts, forming a stable lamellar liquid crystal structure. The formulation promotes gentle exfoliation, improved hydration, and sustained release of active herbal ingredients. Evaluation parameters such as pH, viscosity, spread ability, stability, and skin irritation confirmed that the cream possessed acceptable physicochemical properties and was non-irritant to the skin. The results suggest that the developed herbal exfoliating liquid crystal cream is a safe, stable, and effective natural cosmeceutical formulation with potential for improving skin texture and appearance.

KEY WORDS: Herbal exfoliating cream, Liquid crystal system, Natural exfoliants, Cosmeceutical formulation, Skin hydration, Stability evaluation.

I. INTRODUCTION

Myrciaria dubia (camu-camu) is an Amazonian shrub adapted to flood-plain environments and is valued for its fruit, which is exceptionally rich in vitamin C and antioxidants such as polyphenols and flavonoids. Traditionally used to enhance immunity and reduce inflammation, camu-camu is now widely studied for its anti-aging, antioxidant, and skin-brightening properties, leading to increased use in nutraceutical, cosmetic, and functional-food products¹.

A cream is a semi-solid topical preparation formed by emulsifying oil and water, used for moisturizing, protection, healing, and delivering active ingredients. Creams are mainly of two types: oil-in-water creams, which are light, non-greasy, and easily washable, and water-in-oil creams, which are thicker and more occlusive, suitable for dry skin².

Exfoliation is a cosmetology process involving the removal of dead skin cells and debris from the skin surface to promote skin regeneration and thorough

cleansing. It can be achieved through mechanical or chemical methods such as microdermabrasion and chemical peels and is commonly used to enhance skin appearance and maintain youthful, healthy skin³.

The skin is the largest organ of the body, covering about 2 m and weighing over 5 kg in adults. It consists of three main layers: epidermis, dermis, and subcutaneous fat. The epidermis is a thin stratified layer mainly composed of keratinocytes that undergo a 30-day renewal cycle, forming the stratum corneum, which provides barrier function, hydration, and protection through corneocytes and lipids such as ceramides, fatty acids, and sterols. Other epidermal cells include melanocytes (pigmentation), Langerhans cells (immune defence), and Merkel cells (touch). Skin appendages like hair follicles and sweat and sebaceous glands arise from the epidermis. The dermal-epidermal junction contains structural proteins that aid adhesion and cell signalling. The dermis is a connective-tissue layer rich in collagen, elastin, and hyaluronic acid, providing strength, elasticity, hydration, blood supply, nerve endings, and support to skin structures⁴.

EXFOLIATING LIQUID CRYSTAL CREAM:

The demand for herbal cosmetic formulations has increased due to preference for natural, safe, and effective skincare. Exfoliating creams help maintain skin health by removing dead cells, oil, and impurities, promoting skin renewal and improved complexion, while synthetic exfoliants may cause irritation. To overcome this, a Herbal Exfoliating Liquid Crystal Cream was formulated using natural oils and herbal extracts such as Camu Camu, Aloe vera, and Green tea for their exfoliating, antioxidant, and skin-brightening effects. The liquid crystal (lamellar) emulsion system provides a smooth, stable cream with enhanced skin absorption, moisture retention, and controlled release of active ingredients.

The cream was evaluated for pH, viscosity, spreadability, stability, and skin compatibility, demonstrating its safety, quality, and potential use in modern herbal cosmetology⁵.

PERMEATION:

Liquid-crystal (LC) creams enhance herbal active delivery by improving skin penetration and permeation. They provide controlled release, increase hydration, reduce TEWL, and protect sensitive phytochemicals. Nanostructured LC systems improve retention and targeting, while also enhancing the antioxidant and anti-inflammatory effects of herbal actives⁶.

HISTORY:

Liquid-crystal (LC) technology was discovered in 1888 and progressed through the 20th century in physics and chemistry. Cosmetic applications emerged in the 1990s–2000s with LC-based product patents. From the 2000s–2010s, lamellar LC emulsions that mimic skin lipids gained use for better moisturization and active delivery. During the 2010s–2020s, research expanded on LC stability, skin interaction, and drug delivery. Recent studies (2020–2025) focus on herbal liquid-crystal creams and their topical benefits⁷.

IDEAL PROPERTIES

SKIN TYPE: Dry, normal, sensitive, and oily.

USAGE: Twice daily after cleansing; sunscreen in AM.

AMOUNT: Pea-sized, massage until absorbed.

BENEFITS: Hydration, moisturization, non-greasy, better delivery of herbal actives, anti-aging/skin repair.

PRECAUTIONS: Patch test, avoid eyes, stop if irritation, caution with strong actives.

II. AIMS AND OBJECTIVES

AIM: To formulate and evaluate a Herbal Exfoliating Liquid Crystal Cream incorporating natural ingredients to achieve effective exfoliation, hydration, and skin rejuvenation through liquid crystal technology.

OBJECTIVES:

To select suitable herbal extracts and natural excipients possessing exfoliating, antioxidant, and moisturizing properties.

To develop a stable liquid crystal cream formulation using natural oils, emulsifiers, and humectants.

To evaluate the physicochemical characteristics of the prepared formulation, including appearance, pH, viscosity, spread ability, and stability.

To assess the safety and skin compatibility of the cream through irritation and stability studies.

III. MATERIALS AND METHODS

COLLECTION OF PLANT MATERIAL:

Seeds of *Myrciaria dubia* were collected from Kerala during the months of November and May, corresponding to suitable seasonal availability. Following

collection, the fruits were manually processed to separate the seeds from the pulp. The seeds were thoroughly cleaned to remove adhering impurities and visually inspected to ensure acceptable quality prior to use. Only healthy, undamaged seeds were selected for subsequent extraction and formulation processes, ensuring consistency and reliability of experimental outcomes.

DRYING AND STORAGE OF SEEDS:

The cleaned seeds were washed with distilled water and subjected to shade drying at ambient room temperature for a duration of 5–7 days. Shade drying was chosen to minimize thermal degradation and preserve heat-sensitive phytoconstituents. The seeds were turned periodically to ensure uniform drying and to prevent fungal contamination. Drying was continued until a constant weight was achieved, indicating effective moisture removal. The dried seeds were then transferred to airtight containers and stored under controlled conditions until further processing.

DRUG PROFILE:

MYRCIARIA DUBIA (CAMU CAMU):



Figure 1. *Myrciaria dubia*

- Biological source:** It is obtained from the fresh or dried fruits (pulp and peel) of *Myrciaria dubia* (Kunth) McVaugh
- Family:** Myrtaceae.
- Plant description:** It is commonly known as camu-camu, is a small evergreen shrub or tree. It grows 2–5 m tall and is native to the Amazon basin, occurring along seasonally flooded riverbanks and wetlands. The plant has simple, opposite leaves, small white bisexual flowers, and globose red fruits rich in vitamin C.
- Plant part used:** The fruits are the main part used, particularly the pulp and peel, for medicinal, nutraceutical, and cosmetic purposes.
- Chemical constituents:** It is Very high in ascorbic acid (vitamin C); polyphenols (flavonoids, anthocyanins), tannins, carotenoids, amino acids, and minerals.

IV. EXTRACTION PROCEDURE:

Approximately 25g of finely powdered *Myrciaria dubia* seed material was weighed and transferred into a conical flask. To this, 250mL of 70% ethanol was added, maintaining a plant-to-solvent ratio of 1:10 (w/v), which is considered optimal for efficient extraction. The mixture was gently agitated to ensure uniform contact between solvent and plant material and then allowed to stand at room temperature (25–28 °C) for 48 hours. The container was intermittently shaken every 12 hours to facilitate the release of bioactive compounds. After maceration, the mixture was filtered using Whatman No. 1 filter paper to obtain the ethanolic extract. The residual plant material (marc) was retained for possible re-extraction to maximize phytochemical recovery.

V. PRELIMINARY PHYTOCHEMICAL SCREENING

Qualitative phytochemical analysis was conducted on the ethanolic extract to identify major classes of secondary metabolites using standard chemical tests.

1. DETECTION OF ALKALOIDS DRAGENDORFF'S TEST:

When a small amount of the filtrate was treated with 1-2 mL of Dragendorff's reagent, a reddish-brown precipitate appeared, confirming the presence of alkaloids⁸.

2. DETECTION OF CAROTENOIDS:

One gram of the extract was mixed with 10 mL of chloroform, shaken well, and filtered. Concentrated sulfuric acid was then added to the filtrate, producing a blue colour at the interface, which indicates the presence of carotenoids⁹.

3. DETECTION OF TANNINS GELATIN TEST:

The plant extract was dissolved in 5 mL of distilled water, then 1% gelatine solution and 10% sodium chloride were added. The formation of a white precipitate indicates the presence of tannins¹⁰.

4. DETECTION OF PROTEINS AND AMINO ACIDS MILLON'S TEST:

A few drops of Millon's reagent were added to 2 mL of the filtrate, resulting in a white precipitate, which indicates the presence of proteins and amino acids¹¹.

5. DETECTION OF FLAVONOIDS LEAD ACETATE TEST:

A few drops of 10% lead acetate solution were added to 1 mL of the plant extract, resulting in a yellow precipitate, which indicates the presence of flavonoids¹².

6. DETECTION OF PHENOLIC COMPOUNDS IODINE TEST:

A few drops of dilute iodine solution were added to 1 mL of the extract, producing a temporary red colour, which indicates the presence of phenolic compounds¹³.

VI. FORMULATION OF HERBAL EXFOLIATING LIQUID CRYSTAL CREAM

PHASE	INGREDIENT	QUANTITY
A (Oil Phase)	Jojoba oil	2.5 ml
	Caprylic/Capric triglycerides	3.7 ml
	Soya lecithin	0.7 ml
	Cetearyl alcohol	0.8 g
B (Aqueous phase)	Distilled water	13 ml
	Glycerine	1.25 ml
	Aloe vera gel	0.1 g
	Xanthan gum	0.1 g
C (Cooling Phase)	Camu Camu extract	2%
	Vitamin E	1 drop
	Lavender essential oil	1 drop

PREPARATION OF HERBAL EXFOLIATING LIQUID CRYSTAL CREAM FORMULATION:

A lamellar liquid-crystal-based herbal cream containing *Myrciaria dubia* seed extract was formulated using a standard emulsification method.

1) Oil Phase (Phase A):

All oil-soluble ingredients were combined and heated to 70–75 °C. Soya lecithin was completely melted to facilitate lamellar structure formation.

2) Aqueous Phase (Phase B):

Distilled water was heated to 75 °C, followed by the addition of glycerine and aloe vera gel with continuous stirring. Xanthan gum was slowly dispersed to avoid clumping.

3) Emulsion Formation:

The hot aqueous phase was gradually added to the oil phase under homogenization. The mixture was stirred at 500 rpm for 10 minutes using a magnetic stirrer to promote liquid-crystal formation.

4) Cooling Phase (Phase C):

Upon cooling the emulsion to 40 °C, camu camu seed extract, vitamin E, and essential oil were incorporated with gentle stirring to maintain emulsion integrity.

5) Packaging:

The finished cream was transferred into airtight containers and stored at room temperature (25 °C).

VII. EVALUATION PARAMETERS

A. PHYSICAL APPEARANCE:

The liquid crystal cream formulations were examined for colour, odour, physical state, and consistency. All formulations appeared off white in colour with a pleasant odour. They were semisolid in nature and showed a smooth and uniform texture upon manual application¹⁴.

B. pH DETERMINATION:

The pH of the formulations was determined using a digital pH meter after preparing a 10% w/v cream dispersion. Calibration was performed using standard buffer solutions. All formulations exhibited pH values within the range of 5.0 to 6.5, which is considered ideal for skin application¹⁵.

C. VISCOSITY:

The viscosity of the liquid crystal cream was measured using a Brookfield viscometer at 25 °C. All

formulations showed suitable viscosity, indicating ease of application, good texture, and resistance to phase separation during storage¹⁶.

D. SPREAD ABILITY:

Spread ability determines how easily the cream can be applied over the skin surface. The test was conducted by placing the cream between two glass slides and measuring the time required for the slides to separate under a specified load. All formulations showed spread ability values within the acceptable range, indicating good spreading ability and user convenience during application¹⁷.

E. PHASE SEPARATION:

The creams were stored in transparent containers at different temperatures and observed for phase separation. No oil or aqueous phase separation, cracking, or creaming was observed in any formulation, confirming the stability of the liquid crystal system¹⁸.

F. WASHABILITY:

Washability was evaluated by applying the cream to the skin and washing it with water. All formulations were found to be easily washable¹⁸.

G. AFTER FEEL:

Sensory evaluation was carried out on healthy human volunteers to assess parameters such as smoothness, stickiness, cooling effect, and residual film. All formulations exhibited good emolliency, smooth texture, and minimal residue. The creams were rated as having a pleasant after- feel, indicating good user acceptability¹⁸.

H. IRRITANCY TEST:

The irritancy test was performed to evaluate skin safety. The cream was applied on human skin and observed for 24 - 48 hours. No signs of redness, swelling, inflammation, or irritation were observed, confirming that the formulation is non-irritant and safe for topical use¹⁹.

I. GREASINESS:

Greasiness was assessed using blotting paper, and no oily stains were observed. These results indicate that the creams are non-greasy and comfortable for daily use¹⁹.

VIII. RESULTS AND DISCUSSION

a) PHYSICAL APPEARANCE:

All liquid crystal cream formulations were off-white, semisolid, and exhibited a pleasant herbal odour. The creams showed a smooth, uniform texture, indicating

homogeneous dispersion and desirable physical characteristics for topical application.

Figure 2. Physical Appearance of cream

Formulation	Colour	Odour	State	Consistency
F1	Off white	Pleasant	semisolid	Smooth
F2	Off white	Pleasant	semisolid	Smooth
F3	Off white	Pleasant	semisolid	Smooth

b) pH DETERMINATION:

The cream formulations showed a pH of 5.0–6.5, within the skin-friendly range, indicating they are non-irritating and suitable for topical application.

Formulations (F)	pH
F1	5.2
F2	5.8
F3	6.4



c) VISCOSITY:

The cream showed suitable viscosity, ensuring smooth texture, easy application, and stability during storage.

Formulations (F)	Viscosity
F1	12,500 cP
F2	28,700 cP
F3	45,300 cP

d) SPREAD ABILITY:

All cream formulations showed spread ability within the acceptable range. This indicates that the creams can be easily applied and spread uniformly on the skin with minimal effort, ensuring good user convenience and suitability for topical application.

Formulations (F)	Spread ability (gm.cm/sec)
F1	5.6 gcm/s
F2	7.4 gcm/s
F3	9.2 gcm/s

e) PHASE SEPARATION:

All formulations remained stable with no phase separation, cracking, or creaming, confirming good physical stability of the liquid crystal system.

f) WASHABILITY:

All formulations were easily washable with water, indicating good acceptability and suitability for topical use without leaving a greasy residue.

g) AFTER FEEL:

All formulations showed good smoothness, emolliency, and minimal stickiness with a pleasant cooling effect and negligible residual film. These sensory attributes indicate high user acceptability and suitability for topical application.

h) IRRITANCY TEST:

No signs of redness, swelling, inflammation, or irritation were observed during the 24–48 hour study period. This confirms that the formulation is non-irritant and safe for topical application.

i) GREASINESS:

No oily stains were observed on blotting paper, indicating that the formulations are non-greasy and provide a comfortable feel suitable for daily use.

IX. CONCLUSION

The present study successfully achieved the formulation and evaluation of a Herbal Exfoliating Cream for healthy and youthful skin using natural ingredients and a suitable cream base. The formulated cream exhibited desirable physical characteristics such as smooth texture, uniform consistency, pleasant appearance, and good spread ability, indicating patient acceptability.

Evaluation studies confirmed that the cream had an appropriate pH compatible with skin, satisfactory viscosity, good spread ability, and acceptable stability, ensuring safe topical application. The presence of herbal constituents provided gentle exfoliation, effective removal of dead skin cells, and contributed antioxidant and nourishing effects that support skin renewal and hydration. Overall, the herbal exfoliating cream demonstrated good performance in both formulation and evaluation parameters, suggesting its potential as a safe, effective, and natural cosmetic product for maintaining healthy, soft, and youthful-looking skin. The use of herbal ingredients also minimizes the risk of adverse effects associated with synthetic exfoliants, making the formulation suitable for regular skincare use.

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