

Formulation and Evaluation of Herbal Skin Cream

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Abstract

Herbal cosmetics have gained significant attention in recent years due to increasing consumer preference for natural and safe skincare products. Herbal skin creams are semisolid formulations enriched with plant-derived ingredients that provide therapeutic as well as cosmetic benefits. These formulations are designed to enhance skin health by utilizing bioactive phytoconstituents such as flavonoids, alkaloids, tannins, essential oils, and vitamins. Herbal creams are generally prepared using oil-in-water (O/W) or water-in-oil (W/O) emulsions depending on the desired application and skin type. Natural ingredients, such as Aloe vera, turmeric, neem, sandalwood, and various essential oils, play a crucial role in providing antimicrobial, anti-inflammatory, antioxidant, and moisturizing effects. The formulation process involves careful selection of excipients, emulsification techniques, and stability considerations to ensure product efficacy and shelf life. Herbal skin creams offer several advantages including minimal side effects, biodegradability, and compatibility with skin physiology. However, challenges, such as variability in plant constituents, stability issues, and standardization, need to be addressed. This review provides a comprehensive understanding of herbal cream formulation and evaluation, serving as a valuable reference for researchers and formulators in the field of cosmeceuticals and herbal drug technology.

Keywords: Herbal cream, cosmeceuticals, phytoconstituents, emulsion, skin care, formulation, evaluation, natural products

INTRODUCTION

Overview of Skin and Its Importance

The skin is the outermost and largest organ of the human body, functioning as a protective shield against environmental factors such as microorganisms, harmful radiation, and chemical exposure [1]. It also plays a crucial role in maintaining body temperature, preventing water loss, and enabling sensory perception. Structurally, the skin is composed of three main layers: epidermis, dermis, and hypodermis.

The demand for skincare products that maintain and restore skin health has led to the rapid growth of the cosmetic and cosmeceutical industries (Figure 1).

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Concept of Herbal Cosmetics

Herbal cosmetics are formulations containing plant-based ingredients that provide cosmetic as well as therapeutic benefits. Unlike synthetic products, herbal formulations utilize naturally occurring bioactive compounds that are generally considered safer and more compatible with skin physiology [2, 3].

Herbal creams are among the most widely used topical preparations due to their ease of application, aesthetic appeal, and ability to deliver active constituents directly to the skin [4].

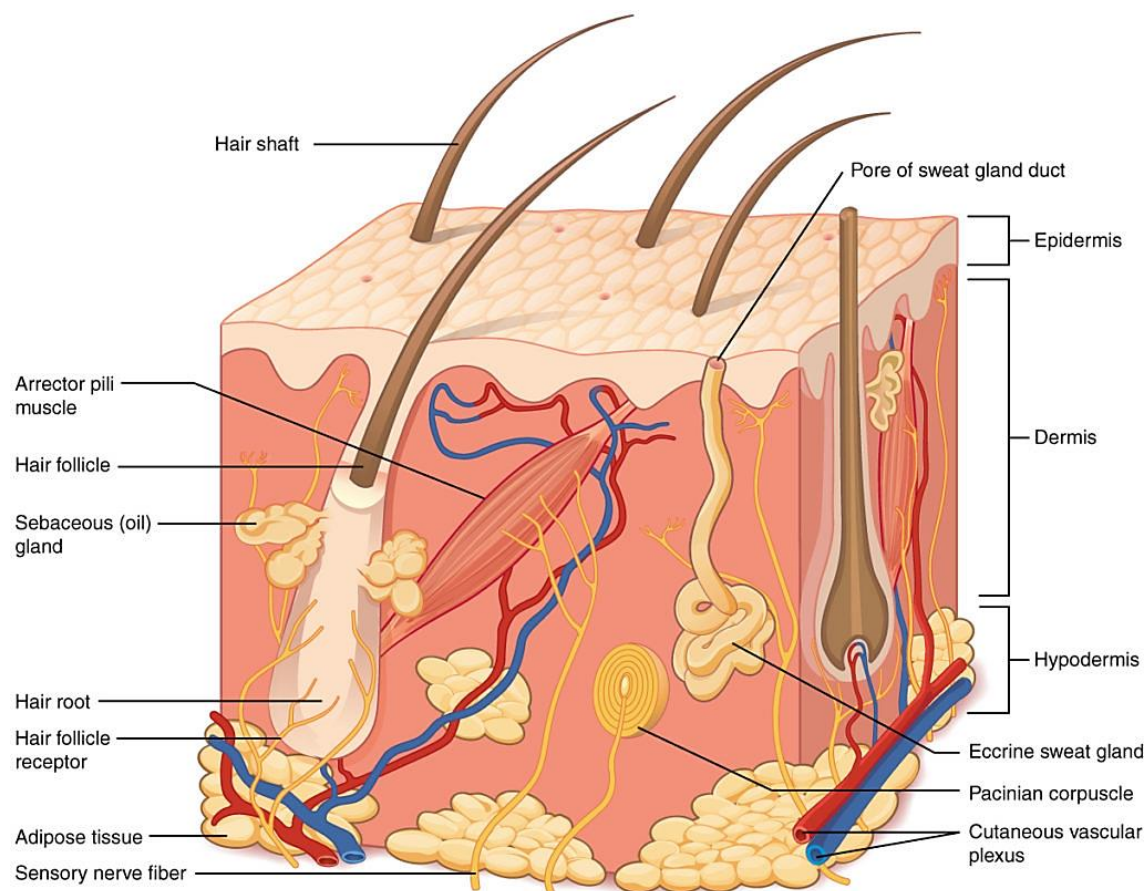


Figure 1. Structure of human skin.

Need for Herbal Skin Creams

The increasing awareness regarding the harmful effects of synthetic chemicals, such as parabens, sulfates, and artificial fragrances, has shifted consumer preference toward herbal alternatives. Herbal skin creams are preferred due to:

- Reduced risk of skin irritation and allergic reactions.
- Presence of natural antioxidants.
- Eco-friendly and biodegradable nature.
- Multifunctional properties (moisturizing, anti-aging, antimicrobial) (Table 1).

Table 1. Comparison between herbal and synthetic skin creams.

Parameter	Herbal creams	Synthetic creams
Source	Natural (plant-based)	Chemical/synthetic.
Safety	Generally safe	May cause irritation.
Side effects	Minimal	Possible adverse effects.
Biodegradability	High	Low.
Stability	Moderate	High.
Cost	Moderate	Variable.

Role of Phytoconstituents in Skin Care

Herbal skin creams derive their efficacy from phytoconstituents present in medicinal plants. These compounds exhibit various pharmacological activities beneficial for skin health.

- *Flavonoids*: Antioxidant and anti-aging effects.
- *Tannins*: Astringent and wound-healing properties.

- *Alkaloids*: Antimicrobial activity.
- *Essential oils*: Fragrance and therapeutic effects.
- *Vitamins (A, C, E)*: Skin nourishment and protection [5].

Scope of the Review

This review aims to provide a detailed understanding of the formulation and evaluation of herbal skin creams, covering aspects, such as:

- Selection of herbal ingredients.
- Formulation techniques.
- Evaluation parameters.
- Applications and limitations.

The study is intended to support research scholars, formulators, and pharmaceutical professionals in developing effective and safe herbal skincare products [6].

Classification of Skin Types and Their Relevance in Cream Formulation

Understanding skin type is essential for designing effective herbal skin creams. Different skin types require specific formulations to maintain optimal hydration and function (Table 2).

Table 2. Classification of skin types and formulation requirements.

Skin type	Characteristics	Formulation requirement
Normal	Balanced moisture, smooth texture	Light emulsions, mild herbal extracts.
Dry	Rough, flaky, low moisture	W/O creams, high emollients.
Oily	Excess sebum, shiny appearance	O/W creams, non-greasy formulations.
Combination	Oily T-zone, dry cheeks	Balanced emulsions.
Sensitive	Easily irritated, reactive	Hypoallergenic herbal ingredients.

Types of Cream-Based Formulations (Rewritten)

Cream formulations are primarily categorized according to the nature of the emulsion system they contain:

- *Oil-in-Water (O/W) Creams*: In these formulations, oil is present as fine droplets dispersed within a continuous aqueous phase. Such creams are light in texture, non-greasy, and can be easily removed with water, making them ideal for individuals with oily or acne-prone skin [7].
- *Water-in-Oil (W/O) Creams*: These formulations consist of water droplets dispersed throughout an oil-based continuous phase. They tend to be thicker, more occlusive, and provide prolonged moisturization, making them suitable for dry or dehydrated skin types (Figure 2).

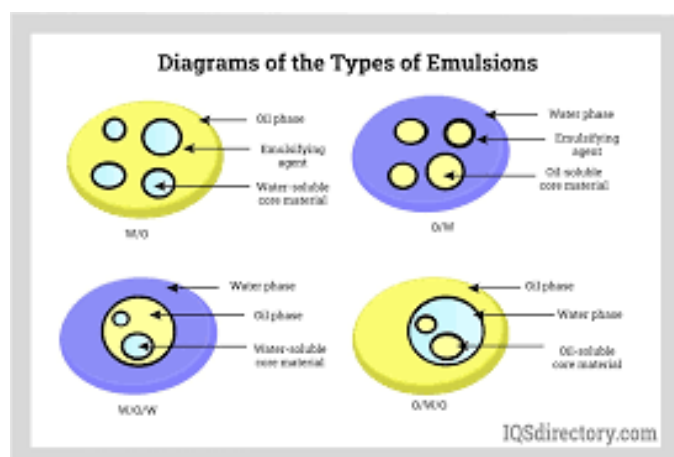


Figure 2. Types of emulsions used in creams.

Role of Herbal Ingredients in Skin Creams

Herbal ingredients are selected based on their pharmacological activity and compatibility with the skin.

Commonly used herbs include:

- *Aloe vera*: Moisturizing and soothing agent.
- *Neem (Azadirachta indica)*: Antimicrobial and anti-inflammatory.
- *Turmeric (Curcuma longa)*: Antioxidant and skin brightening.
- *Sandalwood (Santalum album)*: Cooling and anti-acne properties.
- *Rose oil*: Fragrance and skin toning.

These ingredients contribute to both therapeutic and cosmetic benefits [8, 9].

BACKGROUND

Historical Perspective of Herbal Cosmetics

The use of herbal cosmetics dates back to ancient civilizations such as Egypt, India, and China. Traditional systems, like Ayurveda, have extensively utilized plant-based formulations for skin care and treatment of dermatological conditions.

In Ayurveda, herbal pastes (lepa), oils (taila), and creams were prepared using natural ingredients, like turmeric, sandalwood, and saffron, for enhancing skin complexion and treating infections [10, 11].

Recent Advances in Herbal Cream Formulation

Modern research has integrated traditional herbal knowledge with advanced pharmaceutical techniques to improve the efficacy and stability of herbal creams.

Key advancements include:

- Incorporation of nanoemulsions for enhanced penetration.
- Use of liposomes and phytosomes for targeted delivery.
- Standardization of herbal extracts.
- Improved preservation techniques.

Review of Previous Research Studies

Several studies have been conducted on herbal skin creams demonstrating their effectiveness:

- Formulations containing Aloe vera and neem showed significant antimicrobial activity against skin pathogens.
- Creams enriched with turmeric extract exhibited strong antioxidant and anti-inflammatory properties [12].
- Use of essential oils improved skin hydration and provided aromatherapeutic benefits (Table 3).

Table 3. Summary of selected research studies on herbal creams.

Study focus	Herbal ingredient used	Observed effect
Antimicrobial cream	Neem, Tulsi	Reduced bacterial growth.
Anti-aging cream	Aloe vera, Vitamin E	Improved skin elasticity.
Anti-inflammatory	Turmeric extract	Reduced redness and irritation.
Moisturizing cream	Coconut oil, Shea butter	Enhanced hydration.

Challenges in Herbal Cream Development

Despite their advantages, herbal creams face several formulation challenges:

- Variability in plant constituents due to geographical and seasonal factors.
- Stability issues such as oxidation and microbial contamination.
- Standardization difficulties in herbal extracts.
- Shorter shelf life compared to synthetic products.

Need for Scientific Validation

To ensure safety and efficacy, herbal creams must undergo rigorous evaluation including:

- Physicochemical analysis.
- Microbial testing.
- Stability studies.
- Clinical evaluation.

Scientific validation bridges the gap between traditional knowledge and modern pharmaceutical requirements (Figure 3).



Figure 3. Key steps in herbal cream development.

CLASSIFICATION OF HERBAL SKIN CREAMS

Herbal skin creams can be classified based on their function, formulation type, and therapeutic activity. This classification helps in selecting appropriate ingredients and designing targeted formulations [13].

Classification Based on Function

Herbal creams are categorized according to their intended use:

- *Moisturizing Creams:* Maintain skin hydration and prevent dryness.
- *Anti-Aging Creams:* Reduce wrinkles, fine lines, and improve elasticity.
- *Anti-Acne Creams:* Control sebum production and microbial growth.
- *Skin Whitening/Brightening Creams:* Reduce pigmentation and enhance complexion.
- *Sunscreen Creams:* Protect against harmful UV radiation (Table 4).

Table 4. Functional classification of herbal creams.

Type of cream	Purpose	Common herbal ingredients
Moisturizing	Hydration	Aloe vera, Olive oil.
Anti-aging	Reduce wrinkles	Green tea, Vitamin E.
Anti-acne	Control acne	Neem, Tea tree oil.
Brightening	Improve complexion	Turmeric, Saffron.
Sunscreen	UV protection	Aloe vera, Carrot seed oil.

Classification Based on Emulsion Type

As discussed earlier, herbal creams are broadly classified into:

- *Oil-in-Water (O/W) Creams:* Light, non-greasy, easily washable.
- *Water-in-Oil (W/O) Creams:* Greasy, provide prolonged moisturizing effect.

Classification Based on Therapeutic Activity

- Antimicrobial Creams.
- Anti-inflammatory Creams.
- Antioxidant Creams.
- Wound Healing Creams.

MECHANISM OF ACTION OF HERBAL SKIN CREAMS

Herbal skin creams exert their effects through multiple mechanisms due to the presence of diverse phytoconstituents. These mechanisms contribute to overall skin health and protection.

Penetration of Active Constituents

When applied topically, herbal creams release active compounds that penetrate the stratum corneum (outermost layer of skin). The extent of penetration depends on:

- Molecular size of compounds.
- Lipophilicity.
- Type of formulation (O/W or W/O).

Antioxidant Activity

Free radicals generated by UV radiation and pollution cause skin damage and aging. Herbal ingredients, like flavonoids and polyphenols, neutralize these free radicals [14–16].

Mechanism

- Scavenging reactive oxygen species (ROS).
- Preventing lipid peroxidation.
- Protecting cellular structures.

Anti-Inflammatory Action

Inflammation is a key factor in skin disorders such as acne, eczema, and dermatitis. Herbal constituents, like curcumin and neem extracts, reduce inflammation by:

- Inhibiting inflammatory mediators.
- Reducing redness and swelling.

Antimicrobial Effect

Many herbal extracts exhibit antibacterial and antifungal properties, helping in the prevention of infections.

Examples:

- *Neem*: Effective against bacteria.
- *Tea Tree Oil*: Antifungal and antibacterial.

Moisturizing and Emollient Effect

Herbal oils and extracts help maintain skin hydration by:

- Forming a protective barrier.
- Reducing transepidermal water loss (TEWL).
- Softening and smoothing the skin.

Stimulation of Collagen Production

Certain herbal compounds promote collagen synthesis, improving skin elasticity and reducing signs of aging [17, 18].

Role of Emulsion System in Drug Delivery

The type of emulsion significantly influences drug release and skin absorption:

- *O/W Creams*: Faster release, suitable for quick action.
- *W/O Creams*: Slow release, prolonged effect.

FORMULATION DEVELOPMENT OF HERBAL SKIN CREAM

Formulation development is a critical step in designing an effective herbal skin cream. It involves the selection of suitable ingredients, optimization of their concentrations, and ensuring compatibility among components to achieve desired therapeutic and cosmetic outcomes [19].

Ideal Characteristics of Herbal Skin Cream

An ideal herbal skin cream should possess the following properties:

- Smooth and homogeneous texture.
- Non-greasy and easily spreadable.
- Compatible with skin pH (approximately 5.5–7).
- Stable under different environmental conditions.
- Non-irritant and non-toxic.
- Good aesthetic appeal (color, odor, appearance).

Selection of Ingredients

The formulation of herbal cream includes three major components:

Active Ingredients (Herbal Extracts)

These are responsible for therapeutic effects.

Examples:

- Aloe vera extract.
- Neem extract.
- Turmeric extract.
- Essential oils.

Base Components

These provide structure and consistency to the cream.

- *Oil phase*: Liquid paraffin, beeswax, stearic acid.
- *Water phase*: Purified water, herbal decoctions.

Additives

These improve stability, appearance, and shelf life.

- Emulsifiers (e.g., Tween 80, Span 60).
- Preservatives (e.g., parabens or natural alternatives).
- Humectants (e.g., glycerin).
- Fragrance agents (Table 5).

Table 5. Typical ingredients used in herbal cream formulation.

Ingredient type	Example	Function
Active	Aloe vera, Neem	Therapeutic effect.
Oil phase	Beeswax, Stearic acid	Consistency, emollient.
Water phase	Distilled water	Solvent.
Emulsifier	Tween 80, Span 60	Stabilize emulsion.
Humectant	Glycerin	Moisture retention.
Preservative	Natural extracts	Prevent microbial growth.

Pre-Formulation Studies

Before formulation, pre-formulation studies are conducted to evaluate:

- Solubility of herbal extracts.
- Compatibility with excipients.
- Stability under various conditions.
- Organoleptic properties.

These studies help in optimizing formulation parameters [20].

METHODS OF PREPARATION OF HERBAL SKIN CREAM

The preparation of herbal skin cream generally involves emulsification techniques. The most commonly used method is the fusion method.

Fusion Method (Hot Process)

This method involves heating both oil and aqueous phases separately and then mixing them to form an emulsion.

Procedure

- Oil-soluble ingredients (e.g., beeswax, stearic acid) are melted together at 70–75°C.
- Water-soluble ingredients (e.g., herbal extracts, glycerin) are heated separately to the same temperature.
- The aqueous phase is slowly added to the oil phase with continuous stirring.
- The mixture is stirred until it cools and forms a uniform cream.
- Fragrance and heat-sensitive ingredients are added during the cooling stage [21, 22].

Cold Cream Method

Used mainly for W/O emulsions where heating is minimal.

- Oil phase is mixed with aqueous phase at room temperature.
- Suitable for heat-sensitive ingredients.

Phase Inversion Method

This method involves changing the emulsion type (O/W to W/O or vice versa) by altering temperature or composition.

Homogenization Technique

Mechanical homogenizers are used to:

- Reduce particle size.
- Improve uniformity.
- Enhance stability (Table 6).

Table 6. Comparison of preparation methods.

Method	Advantages	Limitations
Fusion method	Simple, widely used	Not suitable for heat-sensitive actives.
Cold method	Preserves sensitive compounds	Less stable emulsions.
Phase inversion	Improved stability	Complex process.
Homogenization	Uniform particle size	Requires equipment.

Formulation Example (Model Herbal Cream)

Oil Phase

- *Stearic Acid* – 10%.
- *Beeswax* – 5%.
- *Almond Oil* – 8%.

Aqueous Phase

- *Aloe vera Extract* – 10%.
- *Neem Extract* – 5%.
- *Glycerin* – 5%.
- *Distilled Water* – q.s.

Additives

- *Emulsifier* – 3%.
- *Preservative* – 0.5%.
- *Fragrance* – q.s.

EVALUATION AND CHARACTERIZATION OF HERBAL SKIN CREAM

Evaluation of herbal skin cream is essential to ensure its quality, safety, stability, and efficacy. Various physicochemical, microbiological, and biological parameters are assessed to determine the performance of the formulation [23, 24].

Organoleptic Evaluation

This involves visual and sensory inspection of the cream.

Parameters Evaluated

- Color.
- Odor.
- Appearance.
- Texture.

A good herbal cream should be smooth, uniform, and free from phase separation.

Determination of pH

The pH of the cream should be compatible with skin pH (4.5–6.5) to avoid irritation [25].

Method

- Dissolve a small quantity of cream in distilled water.
- Measure pH using a calibrated digital pH meter.

Viscosity Measurement

Viscosity indicates the consistency and flow behavior of the cream.

Method

- Measured using a Brookfield viscometer.
- Determines spreadability and stability.

Spreadability Test

Spreadability reflects the ease of application on the skin [26].

Formula Used

$$S = \frac{M \times L}{T}$$

where:

- S = Spreadability.
- M = Weight tied to upper slide.

- L = Length of glass slide.
- T = Time taken to separate slides.

Homogeneity Test

The cream is visually inspected for:

- Uniform distribution of ingredients.
- Absence of lumps or aggregates.

Skin Irritation Test

This test ensures the safety of the formulation.

Method

- Apply cream on a small area of skin.
- Observe for redness, itching, or irritation for 24 hours.

Washability Test

Determines how easily the cream can be removed with water.

- *O/W Creams*: Easily washable.
- *W/O Creams*: Less washable.

Phase Separation Study

This evaluates the stability of emulsion.

- Store cream at different temperatures.
- Observe for separation of oil and water phases.

Stability Studies

Stability testing is performed under various conditions:

- Room temperature.
- Elevated temperature ($40^{\circ}\text{C} \pm 2^{\circ}\text{C}$).
- Refrigeration.

Parameters Observed

- Color changes.
- Odor.
- pH variation.
- Phase separation (Table 7).

Table 7. Evaluation parameters of herbal cream.

Parameter	Purpose	Method/instrument
Organoleptic	Visual assessment	Observation.
pH	Skin compatibility	pH meter.
Viscosity	Flow behavior	Brookfield viscometer.
Spreadability	Ease of application	Glass slide method.
Homogeneity	Uniformity	Visual inspection.
Irritation test	Safety	Skin application.
Stability	Shelf-life assessment	Storage studies.

Microbial Limit Test

Herbal products are prone to microbial contamination.

Purpose

- Ensure absence of harmful microorganisms.

Tests Include

- Total viable count.
- Detection of pathogens.

In-Vitro Drug Release Study

Determines the rate and extent of release of active constituents.

Method

- Diffusion cell apparatus.
- Semi-permeable membrane.
- Measurement over time.

Rheological Studies

Rheology determines flow behavior and structural characteristics.

- Plastic flow.
- Pseudoplastic flow.
- Thixotropic behavior.

These properties affect application and stability.

Determination of Moisturizing Effect

Assessed using skin hydration studies:

- Corneometer measurement.
- Evaluation of transepidermal water loss (TEWL).

APPLICATIONS, ADVANTAGES & LIMITATIONS OF HERBAL SKIN CREAMS

Applications

Herbal skin creams are widely used in dermatology and cosmetology due to their multifunctional properties. Their applications extend beyond basic skincare to therapeutic and preventive uses [27].

Cosmetic Applications

- Moisturization and nourishment of skin.
- Improvement of skin tone and texture.
- Reduction of wrinkles and fine lines.
- Enhancement of skin glow and radiance.

Therapeutic Applications

- Treatment of acne and pimples.
- Management of eczema and dermatitis.
- Healing of minor wounds and burns.
- Reduction of inflammation and irritation.

Protective Applications

- Protection against UV radiation (herbal sunscreen creams).
- Defense against environmental pollutants.
- Prevention of premature aging [28].

Advantages

Herbal creams offer several benefits over synthetic formulations:

- *Natural Origin*: Derived from plant sources.
- *Reduced Side Effects*: Lower risk of irritation and toxicity.

- *Biocompatibility*: Compatible with skin physiology.
- *Eco-friendly*: Biodegradable and sustainable.
- *Multifunctional*: Provide multiple skin benefits simultaneously [29].

Limitations

Despite their benefits, herbal creams have certain limitations:

- *Variability in Active Constituents*: Due to environmental factors.
- *Stability Issues*: Susceptible to degradation.
- *Microbial Contamination*: Lack of strong preservatives.
- *Short Shelf Life*: Compared to synthetic products.
- *Standardization Challenges*: Difficulty in maintaining uniformity [30].

CONCLUSION

Herbal skin creams represent a promising and evolving segment in the field of cosmeceuticals, driven by the growing demand for safer, natural, and sustainable skincare solutions. The incorporation of plant-derived bioactive compounds offers multiple therapeutic and cosmetic benefits, including antimicrobial, antioxidant, anti-inflammatory, and moisturizing effects. Proper formulation using suitable emulsification techniques and excipients plays a critical role in ensuring the effectiveness, stability, and user acceptability of these products.

Furthermore, systematic evaluation through parameters, such as pH, viscosity, spreadability, homogeneity, and stability, is essential to maintain product quality and performance. Despite their advantages, challenges related to standardization, consistency of herbal ingredients, and long-term stability remain significant and require further research and technological advancement.

Overall, herbal creams hold substantial potential as effective skincare formulations, and continued innovation in formulation strategies and quality control measures will enhance their reliability and wider acceptance in the global market.

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