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Development Of Medicated Poly-Herbal Cream Having Anti-Aging Properties Containing the Distinct Phytoconsitutents

Funny Verma[1], Rishabh Vaishnav[1], Komal Shukla[1], Devid Patel[1*], Sandeep Choudhary[2]

[1]*Mansa Pharmacy College, Bhilai Durg Chhattisgarh*
[2]*Mansa Polytechnic College, Bhilai Durg Chhattisgarh*

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Abstract

Aging is a natural biological process characterized by gradual deterioration of physiological functions, especially visible in the skin. Skin aging is influenced by intrinsic (chronological) and extrinsic (environmental) factors such as ultraviolet radiation, pollution, stress, and poor nutrition. The demand for anti-aging skincare products has significantly increased due to growing awareness of skin health and cosmetic appearance. Synthetic anti-aging creams available in the market such as Pond's Age Miracle Cream, Olay Total Effects 7 in One and L'Oréal Revitalift Cream contain chemical agents like retinoids, parabens, and synthetic antioxidants which may cause irritation and long-term side effects.

Herbal cosmetics have gained popularity due to their safety, efficacy, and minimal adverse effects. The present study aims to formulate and evaluate a polyherbal anti-aging cream using natural ingredients such as Aloe vera, Turmeric, Neem, Green tea, Vitamin E, and Almond oil. The formulation was prepared using oil-in-water emulsion method and evaluated for physical appearance, pH, spreadability, irritancy, stability, and homogeneity.

The prepared herbal cream showed satisfactory results with acceptable pH (6.2–6.8), good spreadability, non-irritant nature, and stable consistency. The study concludes that herbal anti-aging cream can be a safer and effective alternative to synthetic creams for reducing wrinkles, fine lines, and improving skin texture.

Keywords: Polyherbal Formulation, Anti-Aging, Cosmetic Science, *Aloe barbadensis*, *Curcuma longa*, Oil-in-Water Emulsion, Skin Homeostasis.

I. Introduction

1. Anatomy and Physiology of Skin

The skin is the largest organ of the human body, accounting for approximately 15% of total body weight. It serves as the primary interface between the internal biological systems and the external environment.

1.1 Layers of the Skin

The human skin is a complex multi-layered organ composed of three primary layers, each possessing distinct histological features and vital physiological roles.

- Epidermis (Top Layer): As the outermost layer of the skin, the epidermis is primarily composed of specialized cells known as Keratinocytes. Within this layer, the Stratum Corneum, often referred to as the horny layer, functions as the body's main physical barrier against environmental aggressors. Additionally, the epidermis houses Melanocytes, which are responsible for the production of melanin. This pigment plays a critical role in protecting the internal structures of the body by absorbing and dissipating harmful ultraviolet (UV) radiation.
- Dermis (Middle Layer): The dermis serves as the "structural" heart of the skin, characterized by a dense and intricate network of Collagen and Elastin fibers. These proteins are essential for maintaining the skin's strength, resilience, and flexibility. This middle layer is highly functional, acting as the primary residence for essential structures such as blood vessels, hair follicles, and sweat glands. Because of its role in providing structural support, most effective anti-aging creams are formulated to target this specific layer to restore lost elasticity and reduce the appearance of wrinkles.
- Hypodermis (Subcutaneous Layer): The innermost layer, known as the hypodermis or subcutaneous layer, is predominantly composed of adipose (fat) tissue. This layer is crucial for bodily maintenance, as it functions as an internal insulator to

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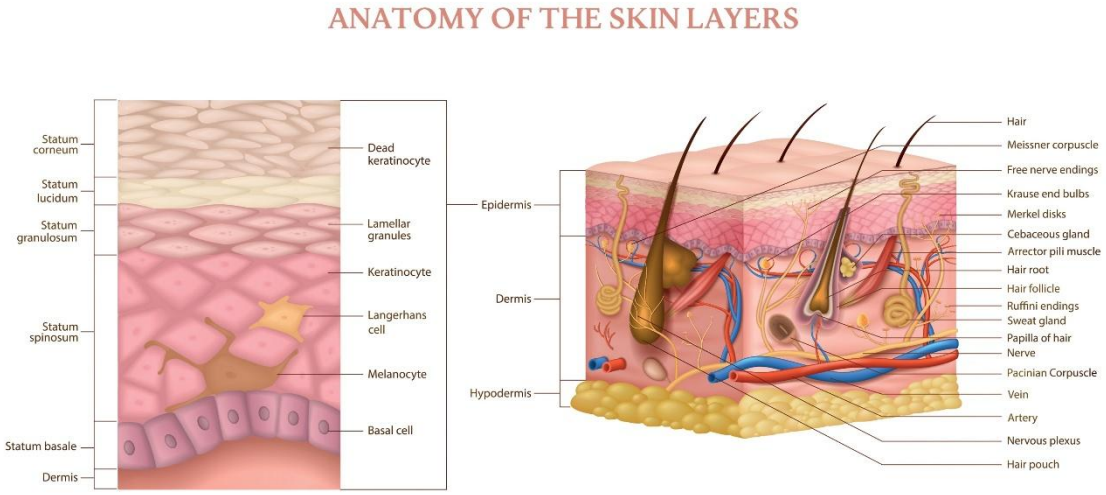
regulate core temperature and serves as a natural shock absorber to protect muscles and bones from external impact.



1.2 Functions of the Skin

The skin is not merely a passive covering; it is a dynamic organ that performs several vital physiological functions essential for maintaining the body's internal stability.Protection (Barrier Function)

- Protection (Barrier Function): The skin acts as the primary interface between internal biological systems and the external environment, serving as a critical physical barrier. The Stratum Corneum within the epidermis specifically prevents the entry of pathogens and protects against chemical and mechanical injuries.
- Thermoregulation: Through the coordination of sweat glands and blood vessels located in the dermis, the skin helps regulate the body's internal temperature. It can dissipate heat through perspiration or conserve it through the insulating properties of the subcutaneous adipose tissue.
- Sensation: The skin is highly sensitized to the environment, housing a complex network of nerve endings that allow for the detection of touch, pressure, temperature, and pain. This sensory input is vital for the body to react to potential external threats.
- Vitamin D Synthesis: When exposed to ultraviolet radiation, the skin initiates the chemical synthesis of Vitamin D, which is necessary for bone health and calcium metabolism.
- Excretion: Through the process of perspiration, the skin assists the body in the elimination of waste products, such as urea, salts, and excess water, via the sweat glands
- Immunological Surveillance: The skin acts as an active component of the immune system, utilizing specialized cells to detect and respond to foreign antigens and pathogens that attempt to penetrate the surface.

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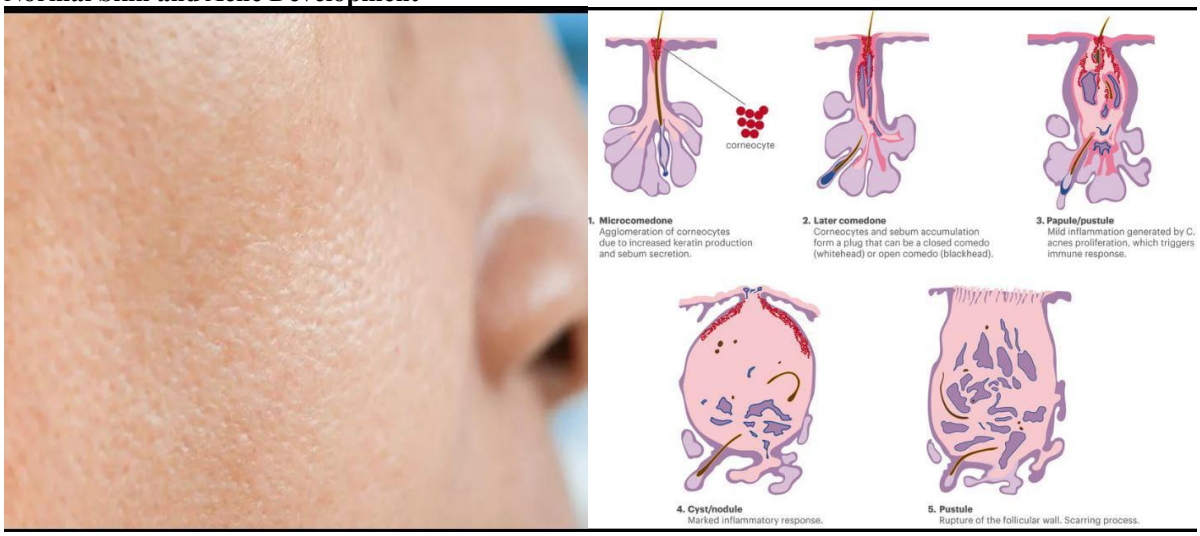
Normal Skin and Acne Development



Acne Development and Progression:

Acne is a complex dermatological condition that primarily develops through a series of interconnected biological events within the pilosebaceous unit. Understanding these stages is essential for developing effective topical treatments that target the root causes of breakouts.

- Excess Sebum Production: The process often begins with the overactivity of the sebaceous glands, frequently triggered by hormonal fluctuations. These glands produce an oily substance known as sebum, which is intended to lubricate the skin; however, when produced in excess, it creates an environment conducive to pore blockage and microbial activity.

- Blocked Pores: As sebum travels toward the skin's surface, it can become trapped by a buildup of dead skin cells (keratinocytes) that fail to shed properly. This accumulation forms a "plug" or comedone, effectively sealing the hair follicle and preventing the natural discharge of oils and cellular debris

- Bacterial Growth: Within the anaerobic (oxygen-free) environment of a blocked pore, specific bacteria—most notably *Cutibacterium acnes*—begin to proliferate rapidly. These bacteria feed on the trapped sebum, leading to the release of metabolic byproducts that further irritate the surrounding skin tissue.

- Inflammation: The final stage of development occurs when the body's immune system detects the bacterial overgrowth and the rupture of the follicle wall. This triggers an inflammatory response, characterized by the influx of white blood cells to the area, resulting in the visible redness, swelling, and pain associated with papules and pustules.

Introduction to Skin Aging

1.1 Definition of Aging

Aging is a complex and progressive biological process characterized by the gradual functional and structural deterioration of skin tissues over time. In the fields of pharmacy and dermatology, this process is categorized into two distinct types based on its underlying causes:

- Intrinsic (Chronological) Aging: This refers to the natural, genetically programmed process that occurs inevitably as time passes, regardless of external influences. On a molecular level, it is driven by cellular senescence—where cells lose their ability to divide—and the progressive shortening of telomeres, which acts as a biological clock for tissue renewal.
- Extrinsic (Photoaging): Unlike intrinsic aging, this type is caused by environmental aggressors, with Ultraviolet (UV) radiation being the primary culprit. Other factors include pollution and lifestyle choices such as smoking. Remarkably, extrinsic factors are responsible for nearly 80% of visible facial skin aging, meaning much of the

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structural damage we observe is technically preventable.

1.2 Clinical Symptoms of Aging

The progression of aging manifests through several specific clinical symptoms that alter both the appearance and the mechanical properties of the skin:

- Rhytides (Wrinkles): These are the most recognizable signs of aging, appearing as fine lines or deep furrows. They result from the breakdown of collagen and elastin fibers in the dermis, coupled with repeated facial expressions.
- Xerosis: This refers to pathologically dry skin. As we age, the skin's ability to retain moisture decreases due to a reduction in natural oils and a thinning of the protective lipid barrier, leading to a rough or flaky texture.
- Hyperpigmentation: Often referred to as "age spots" or "liver spots," this involves the uneven distribution of melanin. It is frequently a result of cumulative sun exposure, where melanocytes become overactive in specific areas.
- Loss of Elasticity: This is the "sagging" effect that occurs when the skin loses its resilience. The degradation of the elastin network means the skin can no longer "snap back" into place after being stretched or moved.
- Telangiectasia: This condition involves the appearance of small, dilated blood vessels near the surface of the skin. They often appear as thin red or purple lines, caused by the thinning of the skin layers and the weakening of the capillary walls.

1.3 Principle of Anti-Aging Action

The fundamental principle of a polyherbal anti-aging cream is to restore the skin's biological homeostasis by addressing the root causes of cellular decline. This is achieved through four primary mechanical pathways that work synergistically to maintain a youthful appearance.

- Antioxidant Protection: This mechanism involves the neutralization of reactive oxygen species (ROS) and free radicals that are generated by environmental stressors like pollution and UV rays. By providing a rich supply of antioxidants—such as the catechins found in Green Tea—the formulation prevents oxidative stress from attacking the DNA of skin cells and breaking down the structural integrity of the dermal matrix.
- Moisturization: Effective anti-aging depends heavily on maintaining the skin's moisture barrier. This process utilizes humectants and emollients, such as Aloe Vera and Glycerin, to draw water into the Stratum Corneum and seal it in. Proper hydration plumps the skin tissues, which immediately reduces the visibility of fine lines and prevents the "creping" effect associated with dehydrated, aged skin.
- Collagen Boosting: As we age, the natural production of collagen—the protein responsible for skin firmness—slows down significantly. The anti-aging principle focuses on stimulating the fibroblasts in the dermis to synthesize new collagen fibers. This helps to "fill" wrinkles from the inside out and restores the structural scaffolding that prevents the skin from sagging.
- UV Shielding: Because photoaging is responsible for the vast majority of visible skin damage, providing a shield against Ultraviolet radiation is a core functional requirement. Natural extracts like Turmeric contain phytochemicals that offer a degree of photoprotection, absorbing harmful rays and preventing them from penetrating into the deeper layers where they cause irreversible damage to elastin and pigment-producing cells.

II. Market Analysis: Commercial Anti-Aging Creams

The global skincare market is saturated with synthetic formulations designed to combat the signs of aging. While these products are widely accessible and backed by extensive marketing, it is essential to understand their composition and the potential drawbacks associated with their long-term use.

2.1 Market Examples:

Several high-profile brands dominate the anti-aging sector, including Pond's Age Miracle Cream, Olay Total Effects 7 in One, and L'Oréal Revitalift Cream. These products are formulated to provide rapid results in reducing the appearance of wrinkles and improving skin tone, making them the standard benchmarks for commercial cosmetic efficacy

2.2 Key Synthetic Ingredients:

The efficacy of these commercial creams typically relies on a specific set of potent chemical agents.

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Retinol (a derivative of Vitamin A) is frequently used to accelerate cell turnover, while Hyaluronic Acid acts as a powerful humectant to retain surface moisture. However, these formulations also often include Parabens as preservatives to extend shelf life and Synthetic Fragrances to enhance the sensory experience of the product.

2.3 Disadvantages and Side Effects:

Despite their effectiveness, synthetic anti-aging creams are frequently associated with dermatological complications. Skin irritation and redness (often referred to as "retinol burn") are common side effects as the skin struggles to adjust to high concentrations of active chemicals. Furthermore, the presence of synthetic additives can trigger allergic reactions, leading to contact dermatitis or increased skin sensitivity, which drives the growing consumer demand for safer, plant-based alternatives.

Example Product Type	Active Ingredients	Physiological Action
Retinoid Creams	Retinol, Tretinoin, Adapalene	Increases cell turnover and collagen production.
Peptide Serums	Matrixyl 3000, Copper Peptides	Acts as signaling molecules to repair skin damage.
Vitamin C Creams	L-Ascorbic Acid, Sodium Ascorbyl Phosphate	Brightens skin and neutralizes free radicals.
Hyaluronic Fillers	Sodium Hyaluronate	Deeply hydrates and "plumps" the skin surface.
Niacinamide Lotions	Vitamin B_3	Strengthens skin barrier and reduces redness.

2.2 Disadvantages of Synthetic Creams

While commercial anti-aging products are widely marketed for their efficacy, their reliance on synthetic chemical compounds often leads to several dermatological and systemic drawbacks that consumers must consider.

- Dermatological Irritation: Many synthetic creams utilize high concentrations of active ingredients like retinoids or alpha-hydroxy acids to force rapid cell turnover. This aggressive chemical action can compromise the skin's natural moisture barrier, resulting in persistent redness, peeling, and a burning sensation commonly referred to as "retinol burn."
- Photosensitivity: Certain synthetic components, particularly synthetic exfoliants and chemical fragrances, can make the skin significantly more vulnerable to ultraviolet radiation. This heightened sensitivity increases the risk of sunburn and paradoxically accelerates photoaging if the user does not apply heavy sun protection, counteracting the original purpose of the anti-aging treatment.
- Chemical Toxicity: The long-term use of synthetic preservatives, such as parabens and phthalates, has raised significant health concerns in the pharmaceutical community. These chemicals can penetrate the epidermal layers and enter the bloodstream,

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where they are suspected of acting as endocrine disruptors, potentially interfering with hormonal balance over years of consistent application.

- Allergic Reactions: Synthetic creams often contain a complex cocktail of artificial dyes and stabilized fragrances to improve shelf-life and consumer appeal. For individuals with sensitive skin, these additives act as potent allergens, triggering contact dermatitis, itching, and inflammatory flare-ups that can leave behind post-inflammatory hyperpigmentation.
- Cost: Beyond the physiological disadvantages, there is a significant economic burden associated with high-end synthetic anti-aging regimens. These products are often positioned as luxury items with high profit margins, making a sustained, long-term skincare routine financially inaccessible for a large segment of the population compared to cost-effective polyherbal alternatives.

Herbal Formulation Introduction

Herbal medicines represent a comprehensive category of healthcare products that include raw herbs, herbal materials, specific herbal preparations, and finished products. These formulations are defined by the presence of active ingredients derived from plant parts, other botanical materials, or a combination of these natural elements to achieve a therapeutic effect. In the context of anti-aging skincare, three primary botanical examples serve as the foundation for this study: *Aloe vera*, Turmeric, and Green tea. These ingredients are selected for their traditional efficacy and safety profile in dermatological applications. Examples:

1. Aloe Vera
2. Turmeric
3. Green Tea

2.1 Herbal Materials

The use of Aloe Vera (*Aloe barbadensis*) is central to the formulation's moisturizing capabilities. Belonging to the *Liliaceae* family, this plant is a biological powerhouse used extensively for its hydrating properties. Within this polyherbal cream, it functions primarily as a deep moisturizer and a potent anti-aging agent, helping to maintain skin elasticity and repair the barrier function of the epidermis.

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1. Turmeric

Turmeric (*Curcuma longa*) is incorporated for its significant medicinal contributions, specifically sourced from the plant's rhizomes. A member of the *Zingiberaceae* family, turmeric is recognized in this study for its powerful anti-inflammatory actions. By reducing inflammation, it helps protect the skin's structural integrity and supports the healing process of damaged tissues.

2. Green Tea

To complete the active blend, Green Tea (*Camellia sinensis*) is utilized for its high concentration of protective compounds. Classified under the *Theaceae* family, green tea provides the formulation with its primary antioxidant defense. Its role is to neutralize free radicals and environmental stressors, thereby preventing the oxidative damage that leads to premature skin aging and the formation of fine lines.

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III. Methods and materials:

Herb / Ingredient	Botanical Source / Chemical Name	Primary Functions
Aloe Vera	*Aloe barbadensis*	Acts as a deep humectant to restore the skin's moisture barrier, promotes tissue regeneration, and provides a cooling effect to soothe irritated skin.
Turmeric	*Curcuma longa*	Provides potent anti-inflammatory benefits through its curcuminoid content, helps even out skin tone, and protects the dermal matrix from inflammatory degradation.
Green Tea	*Camellia sinensis*	Functions as a powerful antioxidant by neutralizing free radicals, protects cells from oxidative stress caused by UV radiation, and helps maintain collagen integrity.
Stearic Acid	Octadecanoic Acid	Functions as a primary emulsifier and thickening agent. It provides the cream with a smooth, pearly consistency and helps to stabilize the oil-in-water emulsion.
Glycerin	Propenetriol	Serves as a powerful humectant that draws moisture from the environment into the epidermis, ensuring the skin remains hydrated and plump.
Cetyl Alcohol	Hexadecan-1-ol	Acts as an emollient and secondary stabilizer. It helps to soften the skin and prevents the different phases of the cream from separating over time.
Potassium Hydroxide	KOH	Used as a neutralizing agent and pH adjuster. It reacts with Stearic Acid to form a soap-like emulsifier (stearate) which helps create the cream's base.
Methylparaben	Methyl 4-hydroxybenzoate	Functions as a broad-spectrum preservative. It prevents the growth of bacteria, yeast, and molds, ensuring the formulation remains safe for use throughout its shelf life.

2.2 Chemical Names and Excipients

- Stearic Acid
  - Chemical Name: Octadecanoic Acid
  - Used:
    - Texture enhancer
    - emulsifier.
- Glycerin: Humectant
  - Chemical Name:Propenetriol
  - Used:

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        - to retain skin moisture
- Acetyl Alcohol:
    - Used:
        - Emollient
        - thickening agent
- Potassium Hydroxide (KOH)
    - Used:
        - Saponifying agent for the stearic acid
- Methylparaben:
    - Used:
        - Antimicrobial preservative

2.3 Formulation Table

Ingredients	Quantity (for 100g)	Role
Herbal Extract Blend	5%	Active Ingredient
Stearic Acid	15g	Oil Phase / Base
Cetyl Alcohol	2g	Stabilizer
Glycerin	5g	Humectant
Triethanolamine	0.5g	pH Adjuster
Purified Water	q.s.100g	Aqueous Phase

2.4Ingredient Table

Ingredient	Biological Source/Chemical Name	Category	Primary Function
Aloe Vera	*Aloe barbadensis*	Herbal Active	Deep moisturization and tissue repair.
Turmeric	*Curcuma longa*	Herbal Active	Anti-inflammatory and UV protection (Curcumin).
Green Tea	*Camellia sinensis*	Herbal Active	Powerful antioxidant (Catechins) to fight free radicals.
Stearic Acid	Octadecanoic Acid	Excipient	Acts as an emulsifier and texture

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Ingredient	Biological Source/Chemical Name	Category	Primary Function
			enhancer.
Glycerin	Propenetriol	Humectant	Retains moisture within the Stratum Corneum.
Cetyl Alcohol	Hexadecan-1-ol	Emollient	Thickening agent and emulsion stabilizer.

3. Procedure:

1. Preparation of Extracts:
   - Maceration of dried herbs in 70% ethanol rightarrow Filtration rightarrow Evaporation.
2. Oil Phase Preparation:
   - Melt Stearic Acid and Cetyl Alcohol at 70°C.
3. Aqueous Phase Preparation:
   - Dissolve Glycerin and TEA in Water; heat to 75°C.
4. Emulsification:
   - Add Oil Phase to Aqueous Phase slowly with continuous stirring at 1200 RPM.
5. Cooling:
   - Allow the emulsion to cool to 45°C.
6. Incorporation:
   - Add herbal extracts and perfume; stir until a smooth cream forms.

IV. Evaluation Tests

The formulated cream underwent several tests to ensure quality and safety.

- pH Determination: Measured at 6.2–6.8, which is compatible with the skin's natural pH.
- Spreadability: Evaluated by the time taken for glass slides to separate under a specific load.
- Viscosity: Measured using a Brookfield Viscometer (Spindle No. 4).
- Homogeneity: Visual inspection confirmed a smooth texture with no lumps.
- Accelerated Stability: Stored at 40°C and 75% RH for 3 months to ensure long-term consistency.
- Irritancy Test: No irritation was observed during topical application tests.
- Greasiness Test: Assessment of the oil-in-water system to confirm a non-greasy feel.
- Centrifugation: Tested to ensure the emulsion does not separate under high-speed rotation.
- Microbial Limit Test: Assessing the efficacy of the preservative system (Methylparaben).
- Dye Test: Used to confirm the oil-in-water nature of the emulsion.

V. Results and Discussion

The formulated polyherbal anti-aging cream was subjected to a series of standardized pharmaceutical evaluations to determine its quality, safety, and consumer acceptability. The following observations were recorded:

Physicochemical Properties and pH: The cream exhibited a refined, pearly white appearance with a pleasant, mild fragrance. Upon testing with a digital pH meter, the formulation consistently showed a pH of 6.2 ± 0.2. This is considered an ideal result, as it closely aligns with the natural slightly acidic pH of human skin, ensuring that the cream does not disrupt the acid mantle or cause chemical imbalance upon application.

Homogeneity and Texture: Visual and tactile inspections confirmed that the cream was smooth and homogenous. There was no evidence of phase separation (creaming or cracking) or the presence of coarse particles. This indicates that the

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emulsification process at 1200 RPM was successful in creating a stable internal structure.

Dermatological Safety: During the patch test evaluation, there was no irritation observed. The skin remained free of erythema (redness) and edema (swelling), confirming that the concentration of herbal extracts and the use of natural bases significantly reduce the risk of the "retinol burn" often associated with synthetic alternatives.

Spreadability and Consistency: The formulation demonstrated good spreadability, requiring minimal mechanical force to cover a wide surface area of the skin. This ensures a uniform distribution of the active herbal ingredients across the epidermis.

Stability Profile: The cream remained stable at room temperature throughout the observation period. It maintained its viscosity, color, and odor, suggesting that the preservative system and the combination of Stearic Acid and Cetyl Alcohol provided a robust shelf-life.

Discussion

The efficacy of this formulation lies in the synergistic relationship between its botanical actives and its modern delivery system. A critical component of the discussion is the "Dual-Shield" mechanism provided by Turmeric and Green Tea. Curcumin, the primary polyphenol in Turmeric, acts as a potent anti-inflammatory agent that intercepts the signaling pathways triggered by UV exposure. Simultaneously, the Catechins (specifically EGCG) in Green Tea serve as high-capacity antioxidants. Together, they provide a dual-layer of protection: while the Green Tea catechins neutralize free radicals at the surface, the Curcumin works to prevent the deep-tissue inflammation that leads to collagen breakdown. This combined action effectively halts the progression of photoaging.

Furthermore, the choice of an Oil-in-Water (o/w) emulsion system is a strategic decision based on consumer sensory requirements. In an o/w system, the oil droplets are dispersed within a continuous aqueous phase. When applied to the skin, the water phase evaporates or is absorbed quickly, providing an immediate cooling sensation and leaving the active herbal oils to penetrate the dermis without leaving a heavy, occlusive film. This is why the system is preferred for its non-greasy feel, making it highly suitable for daily use under makeup or in humid climates, unlike water-in-oil (w/o) creams which can feel tacky and block pores (comedogenic).

VI. Conclusion

The research and development of the formulated polyherbal anti-aging cream demonstrate that it successfully meets all established pharmaceutical standards required for safe and effective topical application. By integrating traditional herbal wisdom—utilizing the proven therapeutic properties of *Aloe vera*, Turmeric, and Green tea—with modern formulation technology, the study has produced a stable and consumer-friendly oil-in-water emulsion.

The evaluation results confirm that the cream maintains a skin-compatible pH, excellent spreadability, and a smooth, homogenous texture without the use of aggressive synthetic chemicals that often lead to dermatological irritation. This formulation offers a viable, cost-effective, and safer alternative to commercial synthetic products, providing comprehensive protection against both intrinsic aging and environmental photoaging.

Looking forward, future studies may involve expanded clinical trials on human subjects to precisely quantify the long-term reduction in fine lines and wrinkles. Such data would further validate the efficacy of these botanical actives in professional dermatological practice and support the continued shift toward organic, plant-based cosmetic science.

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