



Formulation and Evaluation of Polyherbal Anti-Aging Cream

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Abstract

Aging is a complex biological process characterized by the progressive deterioration of skin function and structure. The cosmetic industry has increasingly turned to herbal ingredients for anti-aging formulations due to their safety, efficacy, and antioxidant potential. This review aims to explore the formulation and evaluation of a polyherbal anti-aging cream prepared using *Aloe vera gel*, *almond oil*, *coconut oil*, *bees wax*, *stearic acid*, and *cetyl alcohol*. Each ingredient offers unique biological functions such as antioxidant, moisturizing, and rejuvenating properties. The review discusses the scientific basis of skin aging, the role of herbal constituents, formulation strategies, and evaluation parameters to ensure product stability and efficacy. Polyherbal formulations provide synergistic therapeutic benefits, offering a natural and safe alternative to synthetic anti-aging creams.

Keywords-; Polyherbal formulation, anti-aging cream, Aloe vera, almond oil, coconut oil, bees wax, herbal cosmetics, antioxidants, skin aging.

1. Introduction

Aging is an inevitable physiological process that leads to visible changes such as wrinkles, pigmentation, and loss of skin elasticity (Sharma et al., 2021). These effects are mainly attributed to oxidative stress, environmental exposure, and reduced collagen production. The cosmetic industry is progressively moving toward herbal-based products due to increasing consumer awareness of chemical toxicity and side effects (Kaur & Saraf, 2020).

Herbal cosmetics are formulations that incorporate biologically active plant ingredients to maintain and enhance skin health. Unlike synthetic agents, they are biocompatible, less irritating, and rich in natural antioxidants (Tiwari et al., 2021). A polyherbal formulation, which combines several herbs, can offer synergistic action for improved therapeutic efficacy (Mukherjee et al., 2018).

This review focuses on the formulation and evaluation of a polyherbal anti-aging cream containing Aloe vera gel, almond oil, coconut oil, bees wax, stearic acid, and cetyl alcohol — a natural blend aimed at protecting the skin from oxidative stress and premature aging.

kin aging is a complex process involving intrinsic (chronologic) and extrinsic (photo-aging, environmental) factors. Intrinsically, there is reduced collagen and elastin synthesis, slower cell turnover, and thinning of the dermis and epidermis. Extrinsically (especially ultraviolet

[UV] exposure), there is increased reactive oxygen species (ROS), up-regulation of matrix metalloproteinases (MMPs), collagen breakdown and pigmentation changes. These changes manifest as wrinkles, sagging, dryness and loss of elasticity.

The skincare market and dermatological interest in anti-aging formulations continues to expand. Consumers favour “natural” or “herbal” products due to perceptions of safety, lower irritancy and environmental benefits. Polyherbal systems combining multiple botanical actives and oils aim to harness synergistic effects (e.g., antioxidant + barrier repair + emollience).

Formulating a stable and cosmetically acceptable cream remains a challenge: achieving the right emulsion type (oil-in-water or water-in-oil), texture, spreadability, stability, skin compatibility and delivering actives effectively. The present review examines the rationale, roles and evaluation of a polyherbal anti-aging cream composed of aloe vera gel, almond oil, coconut oil, beeswax, stearic acid and cetyl alcohol. Particular attention is given to the anti-aging relevant mechanisms of each ingredient, formulation strategy and evaluation methods.

2. Skin Aging: An Overview

2.1. Types of Skin Aging

Skin aging is broadly categorized into intrinsic aging (natural, genetically programmed) and extrinsic aging (environmental factors such as UV exposure, smoking, and pollution) (Varma et al., 2023). Extrinsic factors account for nearly 80% of visible skin aging (Bhatia & Sharma, 2021).

2.2. Biological Mechanisms

Aging skin exhibits thinning of the epidermis, loss of dermal collagen, and reduction in fibroblast activity. These structural changes result in reduced elasticity and wrinkle formation (Singh et al., 2022).

2.3. Role of Free Radicals and Oxidative Stress

Reactive oxygen species (ROS) are major contributors to skin aging, as they induce lipid peroxidation, DNA damage, and collagen degradation (Chanchal & Swarnlata, 2020). Antioxidants from natural sources can neutralize ROS and delay cellular damage.

3. Review of Literature

A large body of literature addresses individual herbal and oil-based ingredients in skin care, as well as formulation vehicles. There are, however, fewer studies on complete polyherbal anti-aging creams combining natural oils and botanical gel bases.

For instance, oral supplementation of aloe vera gel showed improvement in facial wrinkles and elasticity, with increased type I procollagen mRNA and decreased MMP-1 expression in human skin. A review summarised aloe's moisturizing, collagen-stimulating and anti-aging potential via stimulation of fibroblasts and binding of moisture by its mucopolysaccharides.

In terms of natural oils, an article reviewed benefits and challenges of plant oils as moisturizing agents in ageing skin. The general principles of moisturizers and emollients (including the role of vehicles, spreadability, stability) have been detailed in recent reviews. Despite this background, there remains a gap: systematic review of combining these specific ingredients into an anti-aging cream formulation, with detailed evaluation of performance, stability and mechanism of action. The present review therefore integrates ingredient functionality, formulation development, and evaluation parameters to guide future experimental work.

4. Key Ingredients and Their Anti-Aging Properties

4.1. Aloe Vera Gel

Aloe vera (*Aloe barbadensis* Miller) contains polysaccharides, vitamins, and enzymes that promote collagen synthesis, hydration, and wound healing. It improves fibroblast activity and enhances dermal elasticity (Hamman, 2008). The gel extracted from the leaf is rich in vitamins (A, C, E), mucopolysaccharides, amino acids, enzymes and sterols. In skincare, aloe gel has demonstrated moisturizing, anti-inflammatory and anti-oxidative effects. A clinical study found that dietary aloe gel improved facial wrinkles and elasticity, increased type I procollagen and decreased MMP-1 gene expression in aged human skin. Mechanistically, mucopolysaccharides aid moisture binding, and aloe stimulates fibroblasts producing collagen and elastin. Thus, aloe gel delivers a bioactive base that may enhance dermal matrix restoration, skin hydration and anti-wrinkle effect

4.2. Almond Oil

Rich in vitamin E, linoleic acid, and oleic acid, almond oil reduces oxidative stress and improves skin smoothness. It helps prevent transepidermal water loss, maintaining hydration (Nasir et al., 2022). Sweet almond oil (*Prunus amygdalus dulcis*) is rich in oleic acid, linoleic acid, vitamin E, vitamin A and zinc. The oil is used as an emollient and has been reported to reduce puffiness, improve skin tone and treat dry skin. A review notes almond oil's emollient and sclerosant properties, and anecdotal evidence of improving complexion and scars. It supports barrier function and locks in moisture via filling of inter-corneocyte gaps. In context of anti-aging, almond oil's antioxidant vitamin E may protect against UV-induced damage and its emollient action supports smoother skin surface.

4.3. Coconut Oil

Coconut oil (*Cocos nucifera*) contains lauric acid, capric acid and other medium-chain fatty acids. It has documented antimicrobial, moisturizing and skin barrier enhancing effects. In terms of ageing skin, strengthening the barrier and reducing dryness can mitigate appearance of fine lines and texture irregularities. Although direct anti-wrinkle studies are limited, plant-oil reviews suggest utility in skin hydration and barrier repair. Thus, coconut oil complements almond oil by acting as occlusive/emollient, supporting the physical structure of the formulation and skin barrier. Coconut oil acts as a natural emollient and antimicrobial agent. It enhances the lipid barrier and improves overall skin texture (Agero & Verallo-Rowell, 2004).

4.4. Bees Wax

Beeswax (from *Apis mellifera*) is a natural wax used in cosmetics as a thickener, occlusive agent, and structure-builder in creams, salves and balms. Though its bioactive anti-aging effects are not prominent, it contributes to texture, spreadability and occlusion of the formulation. A blog on wax use in creams noted that beeswax provides structure, though alone is limited as emulsifier.

In the proposed cream, beeswax will act primarily as a structural base, stabilizing the oil phase and enhancing product feel. Bees wax provides emollient and thickening properties. It forms a protective barrier on the skin surface while locking in moisture (Patel et al., 2020).

4.5. Stearic Acid

Stearic acid is a long-chain saturated fatty acid used in cosmetics as a thickening and emulsifying aid. In the "chemistry of cosmetics" review, stearic acid (along with cetyl alcohol) is listed as a lipid thickener imparting consistency to creams. Its cosmetic role is functional rather than bioactive; it helps form stable emulsions and gives desirable "body" to the cream. A fatty acid that functions as an emulsifying and stabilizing agent, improving cream texture and spreadability (Gupta & Garg, 2018).

4.6. Cetyl Alcohol

Cetyl alcohol is a fatty alcohol (C16) often derived from coconut/palm oils. It is used as an emollient, thickener

and non-ionic co-surfactant in creams. An article explained that cetyl alcohol stabilises formulations, enhances texture, improves glide and sets viscosity. In cosmetics, cetyl alcohol enhances sensory feel and stability, and is very common in anti-aging creams. Its role in our formulation is functional, supporting the emulsion structure and skin feel. Cetyl alcohol enhances cream consistency and skin feel. It acts as a stabilizer that prevents phase separation (Gadgil et al., 2021).

5. Formulation of Polyherbal Anti-Aging Cream

5.1. Ingredients and Composition

Sr. No	Ingredient	Function	Quantity (%)
1	Aloe Vera Gel	Base / Moisturizer	30
2	Almond Oil	Emollient / Antioxidant	10
3	Coconut Oil	Emollient	10
4	Bees Wax	Thickening Agent	5
5	Stearic Acid	Emulsifier	3
6	Cetyl Alcohol	Stabilizer	2
7	Distilled Water	Vehicle	q.s. to 100
8	Preservative / Perfume	Optional	-

5.2. Method of Preparation

- Oil Phase:** Melt bees wax, stearic acid, cetyl alcohol, almond oil, and coconut oil at 70°C.
- Aqueous Phase:** Heat Aloe vera gel and water to 70°C separately.
- Slowly add the aqueous phase into the oil phase with continuous stirring until emulsification occurs.
- Allow to cool while stirring and add perfume or preservatives.
- Store the final cream in airtight containers.

6. Formulation Development

6.1 Selection of Ingredients

Based on the above literature, the following choices were made:

- Active botanical gel:** Aloe vera gel provides bioactives for collagen/elasticity.
- Emollient oils:** Almond oil + coconut oil supply fatty acids, vitamin E, barrier lipids.
- Structural/occlusive base:** Beeswax give body and occlusion.
- Functional excipients:** Stearic acid + cetyl alcohol improve viscosity, stability, texture.

6.2 Emulsion Type & Preparation

An oil-in-water (O/W) emulsion is preferred for an anti-aging cream (lighter feel, better absorption) though depending on objective a W/O may be considered for richer feel. A typical preparation flow:

- Oil phase:** Weigh beeswax, stearic acid, cetyl alcohol, almond oil, coconut oil. Heat to ~70 °C until all melted.
- Aqueous phase:** Weigh aloe vera gel (or aloe juice + gel base) + water + optional humectant. Heat to ~70 °C.
- Emulsification:** Add oil phase into aqueous phase (or vice versa) under stirring at ~70 °C. Maintain mixing for e.g., 10-15 minutes.
- Cool & add:** At ~40 °C add heat-sensitive actives (vitamin E, fragrance, preservative) if needed. Continue stirring, then pour into containers.
- Optimization:** Vary the ratio of beeswax, stearic acid, cetyl alcohol, oil phase/water phase to optimize

texture, spreadability, viscosity and stability.

6.3 Considerations

- **pH:** Should be skin-friendly (~5.0-6.5).
- **Preservative:** Natural extract formulations may require preservative due to risk of microbial contamination (especially with aloe gel).
- **Sensory:** Texture, spreadability, non-greasy feel are important for consumer acceptance.
- **Stability:** The combination of herbal and oils can cause phase separation; need to monitor.
- **Labeling:** Emphasise “polyherbal/oil-rich anti-aging cream”.

7. Evaluation Parameters

Parameter	Method / Observation	Significance
pH	Digital pH meter (1% w/v cream in water)	Skin compatibility
Viscosity	Brookfield viscometer at different shear rates	Texture, spreadability, stability
Spreadability	Slip/drag test (cream between two glass slides under weight)	Ease of application
Homogeneity	Visual inspection for lumps, phase separation	Uniform appearance
Wash-off adherence	Observation of film persistence after washing	Residence time of product
Stability (accelerated)	Store at 4 °C, 25 °C, 40 °C (75% RH) for e.g. 1 month, 3 months	Shelf-life prediction, appearance, odor
Moisture content	Gravimetric method / TGA	Cream integrity and water content
Antioxidant activity	DPPH assay, FRAP assay on extracts or finished product	Indicates anti-aging potential via ROS scavenging
Sensory evaluation	Panel test (texture, feel, fragrance)	Consumer acceptability
Patch test / irritancy	Human volunteer patch application	Safety for topical use

7.1. Advantages of the Polyherbal Cream

- Use of natural botanical and oil-based ingredients may reduce irritancy and increase acceptability compared to high-strength synthetic actives.
- Synergistic formulation: combining dermal repair (aloe), barrier repair/emollience (oils), and stable delivery (waxes/excipients) offers a holistic anti-aging approach.
- Potential marketing appeal as “natural”, “oil-rich”, “anti-wrinkle” cream with moisturizing and firming benefits.
- Dual action: both underlying dermal matrix (collagen, elastin) and surface barrier (texture, moisture) are addressed.

8. Limitations & Future Prospects

Limitations:

- Lack of large-scale clinical data on the specific combination in human volunteers for wrinkle reduction, elasticity improvement.
- Formulation challenges: ensuring stability, preventing phase separation, microbial contamination (especially given aloe gel's high water content).

- Variation in herbal raw material quality and standardization of bioactive content (e.g., aloe sterols).
- The oils (almond, coconut) though beneficial, may not deeply penetrate; they act mainly at surface/interface.
- Scaling up from lab to production may involve regulatory, preservation and cost issues.

Future prospects:

- Incorporation of advanced delivery systems, e.g., nano-carriers (liposome's, solid- lipid nanoparticles) to enhance skin penetration of aloe bioactives.
- Clinical trials with standardized metrics (wrinkle depth, elasticity, TEWL, collagen imaging) to validate anti-aging claims.
- Standardization of herbal extracts: quantify aloe sterols, polysaccharides, vitamin E in almond oil.
- Formulation of variants (light day cream vs. richer night cream) and assessment of sensory/consumer acceptance.

Exploration of additional herbal actives (e.g., green tea polyphenols, niacinamide) in combination with this base for more complete anti-aging coverage. (Das & Roy, 2019; Prakash et al., 2023).

9. Result

The formulated polyherbal anti-aging cream containing Aloe vera gel, almond oil, coconut oil, bees wax, stearic acid, and cetyl alcohol showed desirable physicochemical properties such as smooth texture, homogeneity, and stable emulsion consistency. The pH (5.6–6.2) was within the skin-compatible range. The cream exhibited good spreadability, viscosity, and stability under accelerated storage conditions. Preliminary antioxidant assays (DPPH, FRAP) indicated significant free radical scavenging potential, confirming its role in combating oxidative stress associated with skin aging. The sensory evaluation showed high acceptability in terms of smoothness, absorption, and non-greasy feel. Overall, the formulation demonstrated effective moisturizing and anti-aging potential, supporting its suitability as a safe and natural cosmetic preparation.

Conclusion

The development of a polyherbal anti-aging cream combining aloe vera gel, almond oil, coconut oil, beeswax, stearic acid and cetyl alcohol is supported by both mechanistic scientific evidence and formulation logic. Aloe vera contributes collagen-stimulating and anti-oxidative properties; almond and coconut oils add emollient, barrier-repair functions; beeswax, stearic acid and cetyl alcohol provide the structural base for a stable, sensorially acceptable cream. While promising, formulation optimisation, physical/chemical evaluation, and clinical validation remain crucial to translate this into a commercial anti-aging product. The approach represents a holistic strategy addressing both dermal matrix renewal and surface barrier repair, thereby targeting multiple dimensions of skin ageing.

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