JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Preparation and Evaluation of Aloe Vera Lotion

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Abstract

The present study focuses on the formulation and evaluation of a herbal *Aloe vera* lotion prepared using natural ingredients with proven therapeutic and cosmetic benefits. *Aloe vera* is an indigenous plant of South Africa and South America, now cultivated worldwide. The gel extracted from its leaves contains biologically active constituents such as anthraquinones, chromones, polysaccharides, and enzymes. These compounds contribute to its diverse pharmacological properties, including anti-inflammatory, antibacterial, antioxidant, and moisturising effects. The formulation was developed using *Aloe vera* gel, almond oil, water, vitamin E, and essential oil, followed by evaluation for parameters such as pH, viscosity, spreadability, and smoothness. The lotion exhibited a skin-compatible pH (5.5), good spreadability, and a non-greasy texture with excellent absorbency. Its biological activity supports wound healing, hydration, and protection against microbial growth. The study concludes that the prepared *Aloe vera* lotion is an effective, safe, and natural skin-care formulation suitable for both cosmetic and therapeutic applications**.**

Keywords: *Aloe vera*, Herbal lotion, Formulation, Evaluation, Moisturising agent

I. INTRODUCTION

Aloe vera has a long history of use in traditional medicine systems, including Ayurveda and Chinese medicine. The name "Aloe vera" is derived from the Arabic word *"Alloeh"*, meaning aloe, and the Latin word *"vera"*, meaning true, together conveying the idea of a "true shining bitter substance" [12]. References to aloe vera can even be found in historical texts such as the Bible. Today, over 250 species of aloe are known worldwide, but commercial cultivation primarily focuses on just two species: *Aloe barbadensis Miller* and *Aloe arborescens*. This plant is also known by many evocative names, including "the wand of heaven," "heaven's blessing," and "the silent healer" [9].

Originally classified under the Liliaceae family, aloe is now placed in the Aloaceae family. Aloe vera is recognised for its remarkable health benefits and is widely used to support overall wellness and treat various ailments.

Plant Description and Habitat:

Aloe vera naturally thrives in arid and semi-arid regions across Africa, Asia, Europe, and the Americas. In India, it is commonly found in states such as Rajasthan, Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu [12].

Geographical Source:

Aloe plants are native to regions of South Africa and South America, but today they are cultivated in many parts of the world, except in extreme climates such as tundra, deserts, and dense rainforests. The plant generally requires around four years to reach full maturity and has an average lifespan of approximately twelve years [10].

Active Constituents:

The aloe leaf is composed of three distinct layers. The outermost layer, about 15–20 cells thick, serves as a protective barrier and is responsible for synthesising carbohydrates and proteins [15]. Aloe vera contains a variety of biologically active compounds, including anthraquinones, chromones, polysaccharides, and enzymes. Additionally, it has been reported to contain essential minerals such as aluminium (Al), boron (B), barium (Ba), calcium (Ca), iron (Fe), magnesium (Mg), sodium (Na), phosphorus (P), and silicon (Si), which contribute to its therapeutic and nutritional properties.

Cultivation:

Aloe vera can be successfully cultivated in marginal and sub-marginal soils with low fertility. The plant is well adapted to alkaline conditions and can tolerate high levels of sodium (Na) and potassium (K) salts. Since its root system is shallow, typically extending only 20–30 cm deep, the soil should not be tilled too deeply before planting.

Propagation is usually carried out through root suckers or rhizome cuttings. Aloe vera grows well under both irrigated and rain-fed conditions, though it requires immediate irrigation after planting to ensure proper establishment. During the summer, however, the plants should be protected from waterlogging, as excessive moisture can adversely affect their growth and root health.

Biological and Pharmacological Activities of *Aloe vera*

Aloe vera demonstrates a broad spectrum of biological and pharmacological actions attributed to its diverse phytochemical constituents. Experimental studies have shown that oral administration of *Aloe vera* extract at a dose of 150 mg/kg per day can prevent adjuvant-induced arthritis by nearly 72% and promote regression by 22–26%. It has also been reported to reduce oedema formation by up to 80%, primarily through inhibition of inflammatory mediators and enhancement of microcirculation [15,16].

The plant's wound-healing potential is well documented—*Aloe vera* gel maintains a moist wound environment, accelerates epithelial cell migration, and decreases inflammation, thereby enhancing tissue repair. It also improves skin hydration, elasticity, and firmness, producing visible anti-ageing effects by reducing wrinkle formation [17,18].

Aloe vera possesses potent **anti-inflammatory**, **antibacterial**, and **antifungal** activities. Studies indicate that its extracts inhibit the growth of *Candida albicans* and exert bactericidal effects against several Gram-positive and Gram-negative bacteria, being effective against seven of twelve tested species [19]. The **latex** obtained from *Aloe vera* leaves contains anthraquinone glycosides (e.g., aloin, aloe-emodin), which display significant **laxative and purgative** effects and are commonly used to relieve constipation [20].

Moreover, *Aloe vera* acts as a natural **immunostimulant**, promoting macrophage activation, increasing T-cell proliferation, and stimulating antibody production. It also exhibits strong **antioxidant** activity by scavenging free radicals and protecting against oxidative stress. Additionally, its **antitumor** potential has been demonstrated through reduction in tumour burden and enhancement of host defence mechanisms [21–24].

MATERIALS AND METHODS

Experimental Work

Equipment:

The following laboratory instruments and equipment were utilized for the experimental procedures:

- Digital balance – for accurate measurement of sample weights.
- pH meter – to determine the pH of the formulation.
- Measuring cylinder – for precise measurement of liquids.
- Glass bowl – used for mixing and preparing the formulation.
- Spoon – for manual stirring and handling of materials.
- Brookfield viscometer – to measure the viscosity of the prepared formulation and ensure consistency.

Fig. 1

Fig.2

Fig. 3

Required Material

Table 1:Materials of formulation

Sr no	Ingredients	Quantity	Category
1	Aloe vera gel	75ml	Moisturizer
2	Almond oil	50ml	Emollient
3	Water	25ml	Liquid vehicle/solvent
4	Vitamin E	One tablespoon	Moisturiser and wound healing
5	Essential oil	18 drops	Nourishment

Preparation Before Formulation

Prior to formulation, it is essential to ensure that the working area and all equipment, utensils, and packaging materials are thoroughly cleaned and sanitized to maintain hygienic conditions and prevent contamination. The formulator should wear appropriate protective gear, including gloves, a lab coat or protective clothing, and a hair cover or cap during the preparation process. This practice ensures safety, accuracy, and product integrity throughout the experimental work.

Method of Formulation

Formulation of Aloe Vera Gel:

1. **Collection of Raw Material:**

Fresh *Aloe vera* leaves were collected, washed thoroughly with distilled water to remove dirt and impurities, and the base and tip portions of each leaf were removed.

2. **Filleting and Extraction:**

The outer green rind of the leaves was carefully separated to obtain the inner mucilaginous gel (filleting). The extracted mucilage was transferred into a clean mixing jar.

3. **Heating and Homogenization:**

The mucilage was gently heated to remove excess moisture and to ensure uniform consistency. The unpasteurized gel was then subjected to grinding or homogenization to obtain a smooth, uniform mixture.

4. **Addition of Active Ingredients:**

Vitamin E was incorporated into the homogenised gel as an antioxidant to enhance stability and provide additional skin benefits.

5. **Pasteurisation:**

The prepared mixture was pasteurised at an appropriate temperature to eliminate microbial contamination while preserving the bioactive components of the gel.

6. **Cooling and Packaging:**

After pasteurisation, the mixture was allowed to cool to room temperature. The resulting *Aloe vera* gel was then packaged into sterilised containers and stored under suitable conditions for further evaluation.

Steps Involved in the Formulation of Aloe Vera Gel and Lotion

1. Reception of Raw Materials

Freshly harvested *Aloe vera* leaves were transported to the processing facility immediately after collection. Only mature leaves (3–4 years old) that were free from physical damage, mould, or rot were selected, ensuring that all active constituents remained at optimal concentrations.

2. Filleting Operation

The outer green rind of the leaves was carefully removed to extract the inner gel. Since the *Aloe vera* gel exhibits better stability when separated from the leaf, the filleting process was completed within 36 hours of harvesting to prevent degradation of bioactive compounds and maintain product quality.

3. Grinding and Homogenization

The extracted gel fillets were subjected to crushing and homogenization using a commercial high-speed tissue homogeniser at room temperature (approximately 25°C). This process helped in achieving a uniform, smooth gel consistency suitable for further formulation.

4. Addition of Vitamin E

The unpasteurized *Aloe vera* gel was enriched with Vitamin E, which acts as a natural antioxidant. This addition not only stabilised the formulation and extended its shelf life but also improved its therapeutic and sensory properties.

5. Pasteurisation

To ensure microbial safety and preserve the bioactivity of the gel, pasteurisation was performed by heating the product to 85–95°C for 1–2 minutes. This controlled heat treatment prevented the development of off-flavours and maintained the integrity of key phytochemicals.

6. Flash Cooling

Immediately after pasteurisation, the gel was rapidly cooled to 5°C or below within 10–15 seconds. This flash-cooling step was essential to retain the biological activity of sensitive components and to prevent further degradation.

7. Storage

The processed *Aloe vera* gel was stored under controlled conditions, maintaining appropriate temperature and relative humidity. These environmental parameters play a critical role in preserving the product's quality, stability, and efficacy.

Formulation of Aloe Vera Lotion

1. A predetermined quantity of the prepared *Aloe vera* gel was measured accurately.

2. All other formulation ingredients—including almond oil, distilled water, Vitamin E, and essential oils—were weighed in the required proportions.

3. The ingredients were transferred to a clean glass or plastic mixing bowl.

4. The *Aloe vera* gel was added first, followed by the other components in sequence.

5. The entire mixture was stirred vigorously until a homogeneous and stable lotion was obtained.

6. The prepared *Aloe vera* lotion was then packed in sterilised containers and stored at room temperature for further evaluation.

Formulation of Aloe Vera Lotion

The *Aloe vera* lotion was prepared using the ingredients listed below. Each component was measured accurately according to the standard composition for 100 mL of formulation, and the corresponding quantities were adjusted proportionally to prepare a 50 mL batch.

7. Table 1: Composition of Aloe Vera Lotion Formulation

S. No.	Ingredients	Standard Value (for 100 mL)	Quantity Taken (for 50 mL)
1	*Aloe vera* Gel	75 mL	37.5 mL
2	Almond Oil	50 mL	25 mL
3	Distilled Water	25 mL	12.5 mL
4	Essential Oil	18 drops	9 drops

S. No.	Ingredients	Standard Value (for 100 mL)	Quantity Taken (for 50 mL)
5	Vitamin E Oil	1 tablespoon	½ tablespoon

Evaluation Parameters of Aloe Vera Lotion

The formulated *Aloe vera* lotion was evaluated for various physicochemical and performance parameters to ensure its quality, stability, and suitability for topical application.

1. Spreadability

Spreadability refers to the ability of a formulation to spread easily over the skin surface upon application. The therapeutic efficacy of topical preparations often depends on their spreading characteristics [16].

It was determined using two glass slides and calculated using the following formula:

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

Where:

- **S** = Spreadability (g·cm/sec)
- **M** = Weight tied to the upper slide (g)
- **L** = Length of the glass slides (cm)
- **T** = Time taken to separate the slides (sec)

A higher value of *S* indicates better spreadability of the lotion.

2. Determination of pH

The pH of a 1% aqueous solution of the formulated lotion was measured using a calibrated digital pH meter at room temperature. The pH of the formulation was found to be **5.5**, which is within the acceptable range for skin compatibility, ensuring it is non-irritant and suitable for topical application.

3. Homogeneity

Homogeneity was assessed visually after the formulation was set in the container. The lotion was examined for uniformity in appearance and the absence of any lumps, air bubbles, or aggregates, indicating good consistency and proper mixing of ingredients.

4. Viscosity

Viscosity measurement was performed using a **Brookfield viscometer** with spindle No. 7 at 60 rpm and 25°C. The test was carried out to determine the lotion's resistance to flow, which affects its spreadability and stability during storage.

5. Smoothness

The smoothness of the lotion was evaluated by gently rubbing a small quantity between the fingers and observing the texture. The formulation exhibited a smooth and homogeneous feel without any grittiness or rough particles, confirming uniform dispersion of components.

6. Absorbency

Absorbency indicates the rate at which the formulation penetrates or is absorbed into the skin. It was evaluated by applying a small amount to the skin surface and observing changes over time. The lotion showed **moderate to fast absorption**, leaving a non-sticky, pleasant after-feel.

7. Consistency and Greasiness

Consistency and greasiness were examined by applying the lotion to the skin. The formulation demonstrated an optimal consistency—neither too thick nor too runny—and showed minimal greasiness, making it cosmetically acceptable for regular use.

8. Appearance

All prepared *Aloe vera* lotion formulations exhibited a **light green colour** with a smooth, uniform texture and a pleasant fragrance, confirming aesthetic appeal and proper ingredient blending.

9. Washability

Washability was assessed by applying the lotion to the hand and rinsing under running water. The formulation was easily washable, leaving no residue or stickiness on the skin surface.

Applications of Aloe Vera

Aloe vera is a versatile medicinal plant with extensive therapeutic and cosmetic applications. Its bioactive constituents, including polysaccharides, vitamins, enzymes, and minerals, contribute to a wide range of health-promoting effects.

1. Digestive Health

Consumption of *Aloe vera* juice aids in maintaining healthy digestion. It acts as a mild laxative, stimulating bowel movements and relieving constipation. Conversely, due to its balancing effect on the intestinal flora, it can also help regulate bowel function and reduce episodes of diarrhoea [25].

2. Immunity Enhancement

Aloe vera enhances the body's natural defence mechanisms by stimulating macrophages—white blood cells that play a key role in fighting infections and viruses. Regular intake of *Aloe vera* juice supports immune modulation and helps strengthen overall resistance against diseases [26].

3. Detoxification

The juice of *Aloe vera* serves as a natural detoxifying agent. It contains a rich blend of vitamins, minerals, and trace elements that help neutralise toxins and oxidative stress. These properties assist the body in maintaining metabolic balance and may contribute to reducing cancer risk through immune stimulation [27].

4. Antidiabetic Effect

Aloe vera gel has demonstrated significant antihyperglycemic properties, making it beneficial in managing type 2 diabetes mellitus. It helps lower blood glucose levels without adversely affecting lipid metabolism or hepatic and renal functions, thus serving as a supportive natural therapy for diabetic patients [28].

5. Respiratory Benefits (Asthma)

When *Aloe vera* extract is stored in dark conditions for 3–10 days, certain proteinoid compounds are formed. These active constituents have shown potential effectiveness in alleviating symptoms of chronic bronchial asthma by reducing airway inflammation and improving respiratory function [29].

6. Cosmetic Applications

Aloe vera gel and powder are widely used in the cosmetic and personal care industry due to their excellent moisturising, soothing, and skin-rejuvenating properties. They are incorporated into various formulations such as shampoos, soaps, facial cleansers, lotions, and moisturising creams. Soaps formulated with *Aloe vera* are gentle on the skin, non-irritating, and leave no residue, making them ideal for sensitive skin types [30].

Conclusion

Aloe vera lotion has been shown to be a natural and effective skin care product with a variety of medicinal and cosmetic advantages. Its moisturizing, calming, anti-inflammatory, and wound-healing qualities are facilitated by the presence of bioactive substances such vitamins, minerals, enzymes, polysaccharides, and amino acids. Regular use of aloe vera lotion improves texture, keeps skin hydrated, and lessens dryness or irritation without any negative side effects.

Result

The Aloe vera lotion had a pleasant appearance, a subtle herbal scent, and was uniform and silky. During storage, it demonstrated good consistency, stability, and spreadability. The lotion was confirmed to be suitable for topical application because its pH fell within the skin-friendly range of 6.2–6.8. The viscosity was suitable for simple use.

Acknowledgement

I express my sincere gratitude to all those who provided valuable guidance and support throughout the completion of this work. Special thanks are extended to the Department of Pharmaceutics and Faculty Members for their encouragement, resources, and technical assistance during the formulation and evaluation of the Aloe vera lotion.

Heartfelt appreciation is also conveyed to colleagues and laboratory staff for their cooperation and helpful suggestions. Finally I am thankful to all those who directly or indirectly contributed to the successful completion of this study.

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