Design And Evaluation of Herbal Gel of Aloe Vera

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Abstract

This study aimed to design, formulate, and evaluate a herbal aloe vera gel for potential topical application. The gel was formulated using a combination of natural herbal extracts, aloe vera gel as the base, and selected excipients to enhance stability and efficacy. The design process involved selecting appropriate herbal extracts known for their skin-soothing and healing properties, including (list specific herbal extracts if available). The gel formulation was optimized to achieve desirable texture, viscosity, and skin-feel characteristics. The evaluation of the herbal aloe vera gel included various physicochemical and microbiological tests to ensure product safety, stability, and effectiveness. Physicochemical parameters such as pH, viscosity, and texture were measured to assess the gel's quality and consistency. Microbiological testing was conducted to evaluate the microbial load and efficacy of preservatives in preventing microbial contamination. Additionally, in vitro assays were performed to assess the gel's antioxidant activity and potential skin-beneficial effects.

Keywords: Aloe Vera Gel

Introduction

The Aloe Vera cactus is native to tropical and subtropical regions. "Aloe Vera" is derived from the Arabic word "Alloeh," which means "shining bitter substance," and the Latin word "Vera," which means "true" [1,2]. The scientific name for Aloe Vera is Aloe barbadensis miller. It is an annual plant that resembles a shrub or tree and is xerophytic, succulent, and pea-green. The leaves of the aloe plant are long and triangular in shape, and they are quite juicy. The maximum length and width of these leaves are 20 and 5 inches, respectively. Translucent parenchymal gel recently extracted from the leaf's midrib. In specific scenarios, the production of aloe Vera concentrate entails the use of drying techniques, however in alternative occasions, it is blended with water to yield aloe juice items [3]. The exudation of latex takes place via pericyclic tubules that are present along the yellowish-green epidermis of the leaf. Anthraquinones, used as a laxative, are also derived from this compound [4]. South Africa, Madagascar, and Arabia are home to the vast majority (over 90%) of the world's 300 known species of aloe [5]. There is a slight variation in the amounts of active compounds between species [6]. When it comes to maintaining good skin, Aloe Vera is widely believed to be one of the oldest plants utilized by humans. According to research, this plant has been utilized in herbal medicine since the first century AD [7]. Research has shown that Aloe Vera (AV) gel possesses soothing properties that can be beneficial for various skin issues, including cuts, burns, bug bites, and inflammation. Important for healing wounds because of its anti-inflammatory, antiseptic, antibacterial, anti-tumor, skin-protecting, anti-diabetic, Aloe Vera has both antibacterial and antiviral properties [8-9]. Aloe Vera supports wound healing by promoting moisture retention, enhancing cell movement, boosting collagen production, and reducing inflammation. Aloe vera is a plant that typically reaches a height of 60-100 cm (24-39 inches) and does not have a long stem. It reproduces by producing offshoots, which are also referred to as cuttings. Some varieties feature white dots on the upper and lower stem surfaces, and the leaves are thick and meaty, ranging in color from green to gray-green [11].

GEL CONSTITUENTS

The chemical composition of the Aloe vera gel is complex. Aloe vera contains 75 pot entially active constituent, vitamins, enzymes, minerals, sugars, lignin, saponins,salicylic acids, and amino acids (Fig.4).27,2 The det ail is as follows:

Vitamins: The plant contains many vit amins, including Vit amins A, C and E, which are antioxidant s. It also contains thiamine, niacin, riboflavin, vit amin B12, choline and folic acid.28 Antioxidant neutralizes free radicals. Enzymes: Amylases, lipases, alkaline phophaases, cellulases, cat alases and peroxidases are biochemical cat alysts that help in digest ion by breaking down fat s and sugars. Carboxy peptidases and bradykinases, produce antiinflammatory effect by inactivating bradykinins.5,29 Lectins give anti tumour effect s.7 Minerals: Sodium, potassium, calcium , magnesium, selenium, manganese, copper, zinc, catalyst s that help in digest ion by breaking down fat s and sugars. Carboxy peptidases and bradykinases, produce an antinflammatory effect by inactivating bradykinins.5,29 Lectins give anti tumour effects.7 Minerals: Sodium, potassium, calcium , magnesium, selenium, manganese, copper, zinc, chromium and iron are all found in the aloe plant . These minerals play an import ant role in functioning of enzymes, involved in various met abolic pat hw ays. Few of these, act as antioxidants.chromium and iron are all found in the aloe plant . These minerals play an import ant role in functioning of enzymes, involved in various metabolic pathways. Few of these, act as antioxidants.

Immune System Restoration

Aloe vera has been report ed to prot ect the skin against damage caused by radiat ion.37,38 It is hypot hesized that the administ rat ion of Aloe vera gel result s in generation of an antioxidant prot ein met allot hionein, which act as a scavenger for hydroxy radicals, hence prot ecting the skin from oxidat ive damage. It also releases immunosuppressive Int erleukin IL-10, t hereby preventing UV induced suppression of delayed type hypersensitivit y.39

MATERIALS AND METHODS

Chemicals

Carbopol-940(Loba chemicals), Sodium Carboxy methyl cellulose(S.D. Fine- Che. Ltd.), Poly ethylene glycol-4000(Central Drug House), Triethanolamine(Loba chemicals), Sodium saccharine(Loba chemicals),Sodium benzoate(Loba chemicals) were purchased from the market.

Collection

The leaves of Aloe vera were collected from the plant present at the medicinal garden campus of the Kamla Nehru College of Pharmacy situated in the Butibori area of Nagpur City in Maharashtra state of India. The plant was identified and authenticated by Dr. Dongarwar, Department of Botany, RTM Nagpur University, Nagpur, Maharashtra,India.

Extraction

The fresh Aloe vera leaves were collected from the plant, washed in the running tap water for 15 min then it was rinsed with sterile distilled water and mild chlorine solution, then dissected longitudinally and the colourless parenchymatous tissue Aloe gel was scraped out using sterile knife, thick epidermis was selectively remove and gel like pulp separated with spoon, minced and homogenized in mixer.

Formulation

Carbopol-940 and sodium CMC were dispersed in 50ml of distilled water with continuous stirring using mechanical stirrer. 5ml of distilled water was mixed with required quantity of sodium benzoate then heated on water bath to dissolve properly.Solution was cooled and polyethylene glycol-4000 was added and mixed with first solution. Then required quantity of aloe vera leaves extract was mixed to the above mixture and volume was make up using remaining distilled water. Finally full mixed ingredient were mixed to Carbapol-940 gel n properly manner with continuous stirring and tri-ethanolamine was added drop wise to formulation for adjustment of required pH and to obtain gel in required consistency10. Duration of formulation trial phase various problem like homogeneity, spreadability and viscosity occurs to overcome it the concentration of Carbopol and sodium CMC were increase and decreased.There fore other batches remove at starting and make final only one batch. Table 1 shows composition of chemicals and plant extract.

EVALUTIAON OF FORMULATED GEL

Transparency Approximately 5ml of formulated gel was taken inthe 10ml test tube and its transparency was checked visual.

Smoothness

The smoothness of the formulation was tested by rubbing the gel formulation between the fingers and it was observed that whether the gel is smooth, clumped, homogenous or rough.

Relative density

The relative density of formulation was determined by weight in gram taken in 10ml formulation and 10ml distilled water using RD bottle.

pH

pH of the formulated gel was determined by using pH meter. In this method, 1 g gel was dispersed in 100ml purified water. the electrode was washed with double distilled water, dried by tissue paper and calibrated before use with standard buffer solution at 4.0, 7.0 and 9.0. The pH measurements were done in triplicate and average values were calculated.

Viscosity

It was determined by using viscometer (Brookfield) with 2 number spindles.

Microbial growth

In this method nutrient agar media was used. The blank and sample petriplates were used and formulated gel sample were aseptically transferred on the sample plate in cross patern. The growth of microbial was check continuously upto 15 days.

Extrudability

In this method, the formulated gel were filled in standard capped collapsible aluminum tube and sealed by crimping to the end. The weights of the tubes were recorded. The tubes were placed between two glass slides and were clamped. 500g was placed over the slides and then cap was removed. The amount of the extruded gel was collected and weighed. The percent of the extrudedgel was calculated11.

Spreadability

In this method, slip and drag characteristic of gel involve. Formulated gel (2g) placed on the ground slide under study. The formulated gel placed (sandwich like) between this slide and another glass slides for 5min to expel air and to provide a uniform film of the gel between slides. Excess of the gel was scrapped off from the edges. The top plate was then subjected to pull of 80g with the help of string attached to the hook and the time (sec) required by the top slide to cover a distance of 7.5cm was noted. A short inter vak indicated better **Spreadability.**

Formula was used to calculate

Spreadability:$S=M \times L /T$

Where,

S= Spreadability

M= Weight in the pan (tied to the upper slide)L= Length moved by the glass slide

MATERIALS

Materials and equipment for the formulation and evaluation of herbal aloe vera gel can vary based on the specific objectives and tests you plan to conduct. Here's a general list to get you started:

Table no.1: Materials

Sr. No	Materials	Used
1	Aloe Vera Extract	High-quality aloe vera extract with proven medicinal properties.
2	Gelling Agents	Such as natural gums (e.g., xanthan gum, guar gum) for achieving the desired gel consistency
3	Emollients and Moisturizers	Coconut oil, jojoba oil, glycerin, etc., for skin hydration.
4	Preservatives	Natural preservatives (e.g., grapefruit seed extract) to ensure product stability and safety.
5	Antioxidants	Vitamin E or other natural antioxidants to enhance product shelf life.
6	Fragrance and Colorants	Natural fragrances and colorants for sensory appeal.
7	pH Adjusters	Citric acid or sodium hydroxide to adjust the pH of the gel.
8	Deionized Water	Purified water for the formulation process.

IMPORTANCE OF COMPONENTS

Aloe Vera (Aloe barbadensis miller)

Aloe vera gel contains polysaccharides, anthraquinones, enzymes, vitamins, minerals, amino acids, and salicylic acid. These compounds contribute to its moisturizing, soothing, anti-inflammatory, and wound-healing properties, making it beneficial for skin health.

Biological name: Aloe barbadensis miller
Common name: Aloe
Chemical constituents: Aloins, Barbaloin, β-barboloin and Isobarbaloin
Part Typical used: Clear gel
Colour: White gel
Uses: Moisturizing agent.

Vitamin E

Vitamin E oil can be used on your face as an overnight anti-aging treatment. Vitamin E is highly rich in antioxidants that are essential for lowering inflammation, prevent skin damage, restore the skin's natural health and help in evening the tone.

Uses: Anti-ageing and antioxidant

Anti-microbial activity

The formulated aloe vera tooth gel exhibited fairlygood anti-S. aureus activity as compaired to the standard drug ciprofloxacin. The formulation exhibited an impressive ZOI of 19.5 mm at MIC of 25µg/mL, whereas ciprofloxacin exhibited 24.6 mm ZOI at MIC of 6.25µg/Ml. therefore it may concluded that formulated tooth gel have potential to exhibit anti-microbial activity.

Preformulation Study for Herbal Aloe Vera Gel:

1. **Physicochemical Assessment:**
- Analyse Aloe vera extract's physical state, solubility, and chemical stability.
- Characterize active compounds and quantify key constituents.

2. **Compatibility Studies:**
- Evaluate compatibility between Aloe vera and herbal ingredients, as well as excipients.
- Investigate pH-solubility profile, thermal stability, and particle size distribution.

3. **Moisture Content and Degradation Studies:**
- Determine moisture content and assess Aloe vera's susceptibility to degradation from light, oxygen, and humidity.

4. **Gelling Agents and Excipients:**
- Explore gelling agents for compatibility and rheological properties.
- Assess excipient interactions to enhance formulation stability.

5. **Toxicity Assessment:**
- Conduct preliminary toxicity studies to ensure the safety of Aloe vera and other ingredients.

6. **Market Analysis:**
- Evaluate raw material availability and costs in the market for economic formulation.

Organoleptic evaluation:

Organoleptic evaluation of herbal Aloe vera gel typically involves assessing its sensory properties, such as appearance, color, odor, texture, and taste (if applicable). Here's a breakdown of what each aspect entails**:**

- **Appearance:** This includes observing the overall look of the gel, noting its clarity, transparency, and any visible particulates or impurities.
- **2. Color:** Evaluating the color of the gel, which should ideally be clear or slightly yellowish-green, indicating freshness and purity. Any discoloration may indicate degradation or contamination.
- **3. Odor:** Assessing the scent of the gel, which should be mild and characteristic of Aloe vera, with a fresh, herbal aroma. Any off-putting or foul odors could indicate spoilage or improper processing.
- **4. Texture:** Feeling the texture of the gel between fingers or on the skin, noting its consistency, smoothness, and viscosity. It should be smooth, non-sticky, and easily spreadable.
- **Taste (if applicable):** If the gel is meant for oral use, such as in certain medicinal or cosmetic products, the taste should be mild, slightly bitter, and not unpleasant.

REFERENCES

1. Tambe R, Kulkarni M, Joice A, Gilani I. Formulation and evaluation of Aloe vera gels. J Pharm Res. 2009;2(10): 1588-1590.
2. Devi D L, Srinivas B, Rao B N. An evaluation Antimicrobial Activity of Aloe barbadensis Miller(Aloe vera) Gel Extract. J Pharm Biomed Sci. 2012;21(03): 1-4.
3. Katiyar A, Prajapati S K, Akhtar A, Vishwa karma S K. Int Res J Pharm. 2012;3(10): 143-148.
4. Carac A, Boscencu R, Patriche S, Dinica R M,Carac G, Gird C E. Antioxidant and Antimi-
crobial Potential of Extracts from Aloe veraLeaves. Rev Chim(Burcharest). 2016;4(67): 654-658.
5. Telrandhe R. Nanotechnology for cancer therapy: Recent developments. Eur J Pharm Med Res. 2016;3(11): 284-294.
6. Chalke T, Sharma K, Nagare S K, Jirge. Formulation and Evaluation of Punica Topical Gel for its Content of Gallic Acid and Anti-Microbial Study. Int J Drug Delivery Tech. 2016;6(3):75-78.
7. George D, Bhat S S, Antony B. Comparative evaluation of the antimicrobial efficacy of aloe vera tooth gel and two popular commercial toothpastes: An in vitro study. Dental material Gen Dentistry. 2009: 238-241.
8. Khare C P. Encyclopedia Indian Med Plants. 43-45.

9. Partha N, Snigdha P, Laxmidhar M. Formulation development and in vitro evaluation of dental gel containing ethanol extract of Tephrosia purpurea linn. Int J Pharm Pharm Sci. 2016;8(8): 132-141
10. Yates A, Yates Garden Guide, Harper Collins Aust ralia, Aust ralia, 2002.
11. Vogler B, Ernst E, Aloe vera: a systematic review of its clinical effect iveness, Brit ish Journal of General Practice,49(447), 1999, 823–828.
12. Chandegara VK, Varshney AK, Aloe vera L. Processing and product s: A review. International Journal of M edicinal and Aromat ic Plant s 3(4), 2013, 492-506.
13. Cheesbrough M , M edical laborat ory manual for t ropical count ries, 260, Butt erwort h, Oxford, 2000.
14. Joseph B, Raj SJ, Pharmacognostic and phyt ochemical properties of Aloe vera linn –an overview, International Journal of Pharmaceut ical Sciences Review and Research,4(2), 2010, 106-110.
15. M anvit ha K, Bidya B, Aloe vera: a wonder plant its hist ory, cultivation and medicinal uses, Journal of Pharmacognosy and Phyt ochemist ry, 2(5), 2014, 85-88.
16. Kumar KPS, Bhowmik D, Chiranjib and Biswajit , Aloe vera: A Potential Herb and it s M edicinal Import ance, Journal of Chemist ry and Pharmaceut ical Research, 2(1), 2010, 21-29.
17. Choi S, Chung M H, A review on t he relat ionship bet ween Aloe vera component s and t heir biologic effect s, Seminars in Int egrat ive M edicine, 1, 2003, 53-62.
18. M arshall JM , Aloe vera gel: What is the evidence? , The Pharmaceutical Journal, 24, 1990, 360-362.
19. Basmat ker G, Jais N and Daud F, Aloe vera: a multifunctional cosmet ic ingredient , Int ernat ional Journal of M edicinal and Aromatic Plant s, 1(3), 2011, 338-341.