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FORMULATION AND EVALUATION OF ALOE VERA - GREEN TEA HERBAL TOPICAL GEL FOR ANTIMICROBIAL AND ANTIOXIDANT ACTIVITY

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ABSTRACT

Herbal formulations have gained significant attention in recent years due to their safety, effectiveness, biocompatibility, and reduced side effects compared to synthetic products. Among various herbal dosage forms, topical gels are widely preferred because they are non-greasy, easily spreadable, washable, and provide better patient compliance. The present study was aimed at the formulation and evaluation of an Aloe vera–Green Tea herbal gel for topical application with potential antioxidant, antimicrobial, moisturizing, and skin-protective properties. Aloe vera is a medicinal plant well known for its soothing, moisturizing, wound-healing, and anti-inflammatory activities. Green tea (*Camellia sinensis*) is rich in catechins and polyphenols, especially epigallocatechin gallate (EGCG), which possess strong antioxidant and antimicrobial activities. The combination of these two herbal ingredients was selected to achieve a synergistic effect for improving overall skin health. Green tea extract was prepared by the percolation method using ethanol as solvent, while aloe vera extract was obtained through ethanol extraction of fresh aloe vera gel. The prepared extracts were incorporated into a gel base containing Carbopol 940 as gelling agent, propylene glycol as humectant, methyl paraben as preservative, and distilled water as vehicle. The formulated herbal gel was evaluated for various physicochemical parameters including physical appearance, pH, viscosity, spreadability, homogeneity, washability, stability, and skin irritation test. The formulated gel showed satisfactory physicochemical characteristics. The gel exhibited smooth texture, uniform consistency, pleasant odour, good spreadability, and acceptable viscosity. The pH of the formulation was found to be compatible with skin, indicating suitability for topical application without irritation. Phytochemical screening confirmed the presence of phenols and flavonoids, which are responsible for antioxidant and antimicrobial activities. To previously published studies, aloe vera and green tea possess significant antimicrobial and antioxidant potential, which may help in protecting the skin from microbial infection, oxidative stress, and premature aging.

Keywords: Topical herbal gel, antimicrobial, antioxidant activity

1. INTRODUCTION

1.1 BACKGROUND

In recent years, interest in herbal and natural products has grown in the fields of pharmaceuticals and cosmetics. This change comes mainly from a greater awareness of the harmful effects of synthetic chemicals. Herbal formulations are safer, compatible with our bodies, and better for the environment. Among different dosage forms, topical gels are popular for skincare because they are non-greasy, easy to apply, improve patient compliance, and allow for better drug release.(1)

The skin is the largest organ of the human body and acts as a protective barrier. It protects the body from harmful environmental factors such as sunlight (UV rays), pollution, dust, and microorganisms. Continuous exposure to these factors can damage the skin. One of the main reasons for skin damage is the formation of reactive oxygen species (ROS), also known as free radicals. These free radicals can damage skin cells, proteins, and DNA, leading to problems like premature aging, wrinkles, inflammation, and other skin disorders.

Therefore, it is very important to use antioxidant substances that can neutralize these free radicals and protect the skin.(2)

Another major problem affecting skin health is microbial infection. The skin comes in contact with many microorganisms such as bacteria and fungi, which can cause infections, acne, and delayed wound healing. Nowadays, the problem of antibiotic resistance is also increasing, making it difficult to treat infections using synthetic drugs. This has increased the need for natural antimicrobial agents that are safe and effective. Many medicinal plants contain compounds that can inhibit the growth of harmful microorganisms without causing side effects.(3)

The skin is continuously exposed to environmental stressors such as ultraviolet (UV) radiation, pollution, and microorganisms. These factors lead to the generation of reactive oxygen species (ROS), resulting in oxidative stress, cellular damage, premature aging, and various dermatological disorders (Briganti and Picardo, 2003). In addition, microbial infections caused by bacteria and fungi can affect the skin, leading to conditions such as acne, dermatitis, and delayed wound healing. Therefore, maintaining healthy skin requires proper care and the use of formulations with antioxidant and antimicrobial properties.(4)

Based on physiological characteristics, skin can be classified into different types, which influence its response to environmental factors and topical formulations.

1.2. TYPES OF SKIN

➢ NORMAL SKIN

Normal skin is well-balanced, with an appropriate level of moisture and oil. It appears smooth, soft, and clear, with minimal imperfections. This type of skin has good blood circulation and is less prone to sensitivity or irritation.(4)

➢ DRY SKIN

Dry skin lacks sufficient moisture and natural oils, making it appear rough, flaky, and dull. It may feel tight and is more prone to irritation, redness, and cracking. This type of skin requires proper hydration and moisturizing agents.(5)

➢ OILY SKIN

Oily skin is characterized by excessive sebum production, leading to a shiny appearance and enlarged pores. It is more prone to acne, blackheads, and microbial infections. Proper cleansing and antimicrobial care are essential for this skin type.(6)

➢ COMBINATION SKIN

Combination skin exhibits characteristics of both oily and dry skin. Typically, the T-zone (forehead, nose, and chin) is oily, while the cheeks remain dry or normal. This type requires balanced skincare to address both conditions.(7)

➢ SENSITIVE SKIN

Sensitive skin is easily irritated and may react to environmental factors, chemicals, or cosmetic products. It often shows redness, itching, or burning sensations. Gentle and soothing formulations are recommended for this skin type.(8)

1.2 HERBAL GEL

Herbal gels are semi-solid dosage forms that incorporate plant-derived active ingredients into a suitable gel base for topical application. In recent years, herbal gels have gained considerable attention in pharmaceutical and cosmetic fields due to their safety, effectiveness, and minimal side effects compared to synthetic formulations (Mishra et al., 2018). The growing demand for natural and eco-friendly products has further encouraged the development of herbal gels as alternative therapeutic systems.(9)

Unlike conventional creams and ointments, gels are non-greasy, easily spreadable, and provide a cooling effect upon application. These properties make them highly acceptable for patients and suitable for a wide range of dermatological applications. Herbal gels are particularly useful for delivering bioactive compounds directly to the skin, allowing localized action with minimal systemic side effects.(10)

1.3.1. ADVANTAGES

- They are non-greasy and do not leave oily residues on the skin
- They provide better spreadability, ensuring uniform application
- They offer a cooling and soothing effect**,** improving patient comfort
- They allow controlled and sustained release of active ingredients(11)
- They enhance drug penetration through the skin
- They are easily washable with water
- They show better patient compliance due to pleasant texture

- They reduce the risk of side effects and toxicity (12)

1.3.2. DISADVANTAGES

- They may be prone to microbial contamination if not properly preserved
- Stability may be affected by temperature and pH changes
- Some formulations may show low penetration of active compounds
- They require proper formulation to maintain consistency and effectiveness(13)

1.3.3. CLASSIFICATION OF GELS

Gels can be classified based on different criteria:

1.3.3.1 BASED ON THE NATURE OF THE LIQUID PHASE

- **HYDROGELS**: These contain water as the main component and are most commonly used for topical applications due to their compatibility with skin.
- **ORGANOGELS**: These contain organic solvents or oils and are used in specialized formulations.
- **XEROGELS**: These are dried forms of gels obtained after removal of the liquid phase. (14)

1.3.3.2. BASED ON STRUCTURE

- **SINGLE-PHASE GELS**: These are homogeneous systems where the polymer is uniformly distributed throughout the liquid phase.
- **TWO-PHASE GELS**: These contain dispersed particles within the continuous liquid phase. (15)

1.3.5. COMPONENTS OF HERBAL GEL

Gels consist of two main components:

- **CONTINUOUS PHASE (LIQUID PHASE)** – usually water
- **DISPERSED PHASE (POLYMERIC NETWORK)** – formed by gelling agents

The interaction between these components results in a structured system capable of retaining large amounts of liquid while maintaining a semi-solid form.

A typical herbal gel formulation contains the following components:

- **ACTIVE INGREDIENTS**

These are the herbal extracts that provide therapeutic activity. In this study, green tea and aloe vera are used for their antioxidant, antimicrobial, and healing properties.(16)

- **GELLING AGENT**

Gelling agents such as Carbopol 940 are responsible for forming the gel structure. They provide viscosity, consistency, and stability to the formulation.(17)

- **SOLVENT (VEHICLE)**

Distilled water is commonly used as the solvent to dissolve and disperse the ingredients.

- **HUMECTANT**

Humectants such as propylene glycol help in retaining moisture and improving hydration of the skin.

- **PRESERVATIVE**

Preservatives like methyl paraben are added to prevent microbial growth and increase the shelf life of the gel.

- **PH ADJUSTER**

pH adjusters such as triethanolamine are used to maintain the pH of the gel within a range suitable for skin application (approximately 5.5 to 7)(8)

1.4. MEDICINAL PLANT

1.4.1 ALOE VERA (*ALOE BARBADENSIS MILLER*)

- **BOTANICAL DESCRIPTION**

Aloe vera is a succulent plant belonging to the family Liliaceae. It is widely distributed in tropical and subtropical regions. The gel obtained from the inner part of its leaves has been used for centuries for medicinal and cosmetic purposes. Aloe vera is well known for its soothing and healing properties.(19

Figure 1: Aloe Vera (*Aloe Barbadensis Miller*)

➢ **PHYTOCHEMICAL CONSTITUENTS**

Aloe vera contains more than 75 biologically active components, including:

- Vitamins (A, C, E, and B-complex)
- Enzymes
- Amino acids
- Polysaccharides (such as acemannan)
- Saponins
- Salicylic acid
- Minerals (20)

➢ **PHARMACOLOGICAL ACTIVITIES**

- **MOISTURIZING EFFECT**

Aloe vera acts as a natural moisturizer, helping to hydrate the skin and maintain its softness.

- **WOUND HEALING ACTIVITY**

Aloe vera promotes tissue repair and regeneration by stimulating collagen synthesis and improving blood circulation.(21)

- **ANTIMICROBIAL ACTIVITY**

The presence of saponins and other compounds provides antimicrobial activity, helping to prevent infections.

- **ANTI-INFLAMMATORY ACTIVITY**

Aloe vera reduces inflammation and soothes irritated skin, making it useful in conditions like burns and dermatitis.(22

➢ **ROLE IN TOPICAL FORMULATION**

➢ In herbal gels, aloe vera plays an important role by:

- Providing hydration and cooling effect
- Enhancing wound healing
- Reducing irritation and inflammation
- Improving overall skin condition(23)

1.4.2. GREEN TEA (*CAMELLIA SINENSIS*)

➢ **BOTANICAL DESCRIPTION**

Green tea is obtained from the leaves of *Camellia sinensis*, a plant belonging to the family Theaceae. It is widely cultivated in countries such as China, India, and Japan. Unlike black tea, green tea undergoes minimal processing, which helps in preserving its natural bioactive compounds. Due to its rich chemical composition, green tea has been extensively studied for its health-promoting properties.(24)

Figure 2: Green Tea (*Camellia Sinensis*)

➢ PHYTOCHEMICAL CONSTITUENTS

Green tea contains a variety of bioactive compounds, among which polyphenols are the most important. The major polyphenolic compounds present in green tea are catechins, including:

- Epigallocatechin gallate (EGCG)
- Epigallocatechin (EGC)
- Epicatechin gallate (ECG)
- Epicatechin (EC)

Among these, EGCG is the most abundant and biologically active compound. In addition to catechins, green tea also contains flavonoids, tannins, caffeine, and amino acids. These compounds contribute to its antioxidant and antimicrobial properties.(25)

➢ PHARMACOLOGICAL ACTIVITIES

Green tea exhibits several important pharmacological activities that make it suitable for topical applications:

- **ANTIOXIDANT ACTIVITY**

Green tea is a powerful antioxidant due to the presence of catechins. These compounds neutralize free radicals and reduce oxidative stress, thereby protecting skin cells from damage. This helps in preventing premature aging, wrinkles, and other skin disorders.

- **ANTIMICROBIAL ACTIVITY**

Green tea has been reported to inhibit the growth of various microorganisms, including bacteria and fungi. This property makes it useful in preventing skin infections and acne.(26)

- **ANTI-INFLAMMATORY ACTIVITY**

Green tea reduces inflammation by inhibiting the production of inflammatory mediators. This helps in soothing irritated skin and reducing redness.

- **Photoprotective Effect**

Green tea polyphenols provide protection against harmful effects of UV radiation, thereby preventing sun-induced skin damage.(27)

➢ ROLE IN TOPICAL FORMULATION

In herbal gel formulations, green tea acts as a key active ingredient by:

- Providing antioxidant protection
- Preventing microbial growth
- Improving skin texture and appearance
- Reducing signs of aging.(28)

➢ COMBINATION OF MEDICINAL PLANT

The combination of green tea (*Camellia sinensis*) and aloe vera (*Aloe barbadensis Miller*) is used to achieve a **synergistic effect**, where the combined action of both herbs is greater than their individual effects. Green tea is rich in polyphenols, especially catechins, which provide strong antioxidant and antimicrobial properties. It helps in neutralizing free radicals and protecting the skin from oxidative damage and aging..(29)

When combined in a single formulation, green tea enhances protection against oxidative stress and microbial infections, while aloe vera improves hydration, reduces irritation, and promotes skin repair. This complementary action results in a more effective topical formulation that provides antioxidant, antimicrobial, anti-inflammatory, and healing benefits simultaneously. Therefore, the combination of these two herbs is widely used in herbal gels to improve overall skin health and therapeutic efficacy.(30)

2. REVIEW OF LITREATURE

SR NO.	AUTHOR	YEAR	KEY FINDING
1	Abid et al,	2025	Aloe vera contains antioxidant, antimicrobial and anti-inflammatory compounds.
2	Abid et al,	2025	Aloe vera rich in polysaccharides, flavonoids and vitamins.
3	Kumar et al,	2025	Aloe vera formulations show enhanced antimicrobial activity.
4	Bonatto et al,	2024	Green tea gel improves fibroblast activity and wound healing.
5	Catalano et al,	2024	Aloe vera shows antiviral, antimicrobial, antifungal and healing activity.
6	Royani et al,	2024	Aloe vera extract contains significant bioactive compounds.
7	Hakeem et al,	2024	Advanced evaluation confirms multiple bioactive components in aloe vera.
8	Lee et al,	2024	Green tea improves skin elasticity and hydration.
9	Kim et al,	2023	Aloe vera is safe and non-genotoxic,
10	Patel et al,	2023	Aloe vera increases collagen and wound healing.
11	Zhang et al,	2023	Green tea provides photoprotection against UV.
12	Singh et al,	2022	Green tea shows antioxidant and anti-inflammatory effects.
13	Khan et al,	2022	Aloe vera shows antimicrobial activity.
14	Rahman et al,	2021	Green tea and aloe vera show strong antioxidant effects.
15	Williamson et al,	2011	Green tea and aloe vera show therapeutic benefits.

3. AIM AND OBJECTIVE

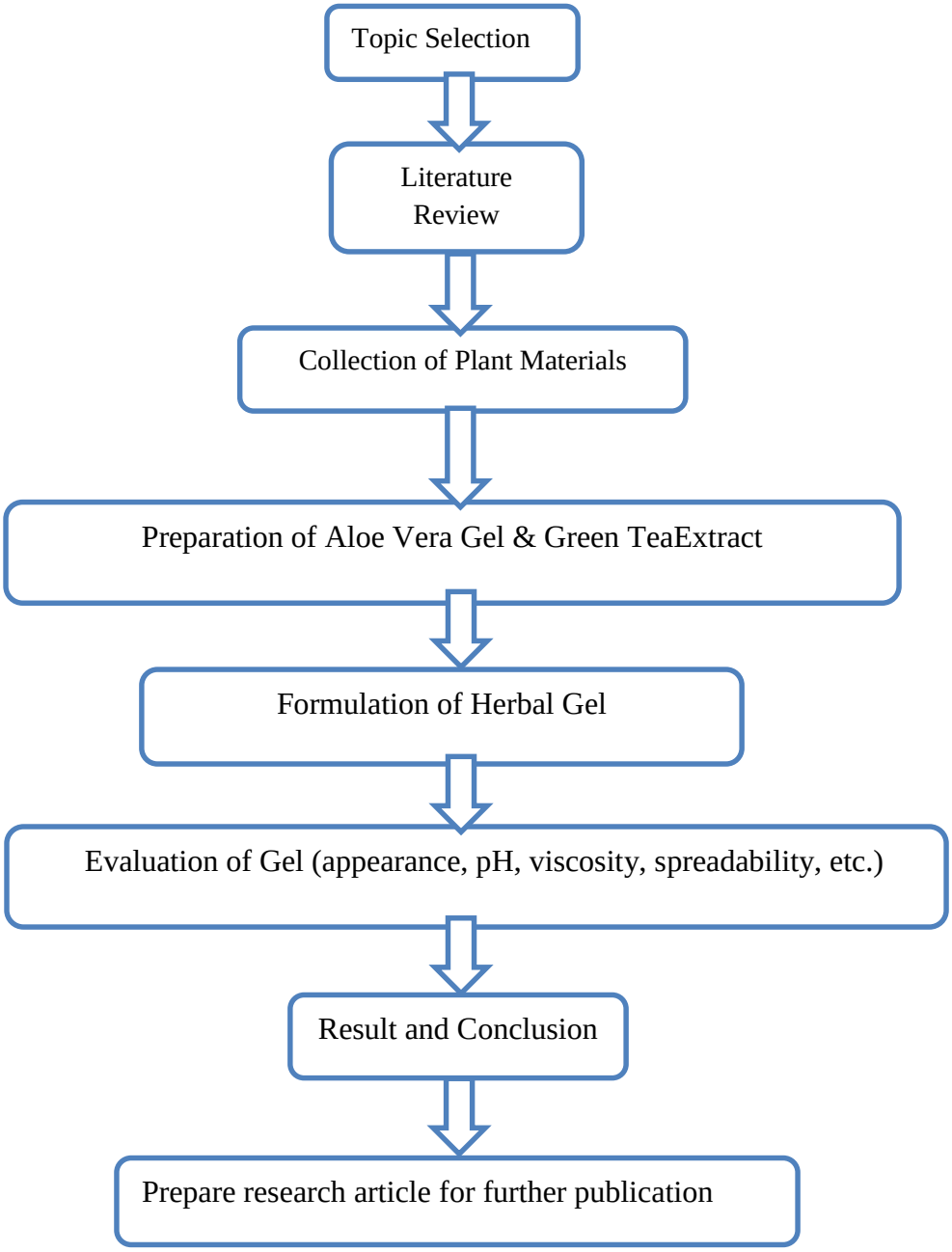
3.1 AIM

To formulate and evaluate an Aloe Vera - Green Tea herbal gel for topical use.

3.2 OBJECTIVES

1. To collect Aloe Vera leaves and Green Tea leaves,
2. To prepare and formulate Aloe Vera gel and Green Tea extract using suitable extraction methods,
3. To evaluate the formulated herbal gel for physicochemical parameters such as: physical appearance, pH, viscosity, spreadability etc.

4. PLAN OF WORK



5. METHODOLOGY

5.1 MATERIAL REQUIRED (31,32)

Table 1: Material Required

Ingredient	Quantity	Purpose
Green tea extract (*Camellia sinensis*)	2–3 ml	Antioxidant, antimicrobial
Aloe vera extract (*Aloe barbadensis Miller*)	5 ml	Moisturizing, healing
Carbopol	0.5 g	Gelling agent (provides viscosity)
Propylene glycol	2 ml	Humectant (retains moisture, improves penetration)
Methyl paraben	0.1 g	Preservative (prevents microbial growth)
Ethanol	5–10 ml	Solvent (used for extraction)
Distilled water	Up to 50 ml	Vehicle (base of gel)

5.2 EXTRACTION OF GREEEN TEA EXTRACT(33-35)

STEP 1. PREPARATION OF DRUG
• Dried green tea leaves were taken and ground into coarse powder using a mortar and pestle.
• Coarse powder was preferred to allow proper solvent flow during extraction.
STEP 2. IMBIBITION (MOISTENING)
• Sufficient ethanol was added to the powder to make it uniformly moist.
• The mixture was mixed properly using a glass rod.
• It was kept aside for 2–4 hours in a closed container.
• This step helped in swelling of the plant material and improved extraction efficiency.
STEP 3. PACKING OF PERCOLATOR
• Filter paper or a cotton plug was placed at the bottom of the percolator.
• The moistened powder was transferred into the percolator.
• The material was packed gently without excessive compression.
• The outlet of the percolator was closed properly.
STEP 4. MACERATION
• Ethanol was added until the powder was completely covered.
• The top of the percolator was closed and allowed to stand for 24 hours.
• This step allowed proper penetration of solvent into the plant material.
STEP 5. PERCOLATION PROCESS
• The outlet was opened and the solvent was allowed to flow slowly in a dropwise manner.
• A steady flow rate was maintained throughout the process.
• The liquid extract (percolate) was collected in a beaker.
STEP 6. COMPLETION OF EXTRACTION
• Fresh ethanol was continuously added from the top of the percolator.
• Percolation was continued until the extract became nearly colorless.
• This indicated complete extraction of active constituents
STEP 7. CONCENTRATION OF EXTRACT
• Ethanol was evaporated at room temperature or under mild heating conditions.
• High temperature was avoided to protect the active compounds.
• A concentrated green tea extract was obtained.

Figure 3: Extraction of Green Tea Extract

5.3 EXTRACTION OF ALOEVERA EXTRACT (36-38)

STEP 1 COLLECTION AND CLEANING

- Collect fresh, healthy aloe vera leaves
- Wash thoroughly with distilled water to remove dirt

STEP 2 REMOVAL OF OUTER LAYER

- Cut both ends and remove spines
- Peel off the green outer covering using a knife
- Separate the inner transparent gel carefully

STEP 3 REMOVAL OF LATEX

- Wash the gel again to remove yellow latex (aloin)
- This step is important to avoid irritation

STEP 4 GRINDING / HOMOGENIZATION

- Cut gel into small pieces
- Grind using motar pestle to form a uniform slurry

STEP 5 ETHANOL EXTRACTION

- Add ethanol in 1:1 ratio with gel a
- Mix thoroughly using a glass rod
- Keep for 15–30 minutes with occasional stirring

STEP 6 FILTRATION

- Filter the mixture using muslin cloth or filter paper
- Remove fibers and solid impurities
- Collect clear extract

STEP 7 CONCENTRATION

- Allow ethanol to evaporate at room temperature or mild heating
- Avoid high temperature to protect active compounds
- Obtain concentrated aloe vera extract

Figure 4: Extraction of Aloevera

5.4 FORMULATION OF HERBAL GEL (40-41)

Step 1 Preparation of Polymer Dispersion

- Weigh **Carbopol (0.5 g)**
- Slowly sprinkle it into distilled water with continuous stirring
- Avoid formation of lumps by adding gradually
- Allow to stand for **2–3 hours** for complete hydration.

STEP 2 PREPARATION OF PRESERVATIVE SOLUTION

- Dissolve methyl paraben (0.1 g) in a small amount of warm distilled water
- Add this solution to the hydrated Carbopol dispersion
- Mix thoroughly

STEP 3 ADDITION OF HUMECTANT

- Add propylene glycol (2 ml)
- Stir continuously to ensure uniform mixing
- Helps in improving moisture retention and consistency

STEP 4 ADDITION OF ALOE VERA EXTRACT

- Add 5 ml aloe vera extract slowly into the mixture
- Stir gently to avoid air bubble formation
- Ensure uniform distribution

STEP 5 ADDITION OF GREEN TEA EXTRACT

- Add 5 ml extract slowly into the mixture
- Stir gently to avoid air bubble formation
- Ensure uniform distribution

STEP 6 GEL FORMATION

- Continue stirring the mixture
- A **se**mi-viscous gel forms due to swelling of Carbopol
- Since no neutralizer is added, the gel may be slightly less thick

STEP 7 FINAL ADJUSTMENT

- Add distilled water to make the volume up to 50 ml
- Mix well to obtain a uniform formulation

STEP 8 PACKAGING

- Transfer into a clean, airtight container
- Store in a cool and dry place

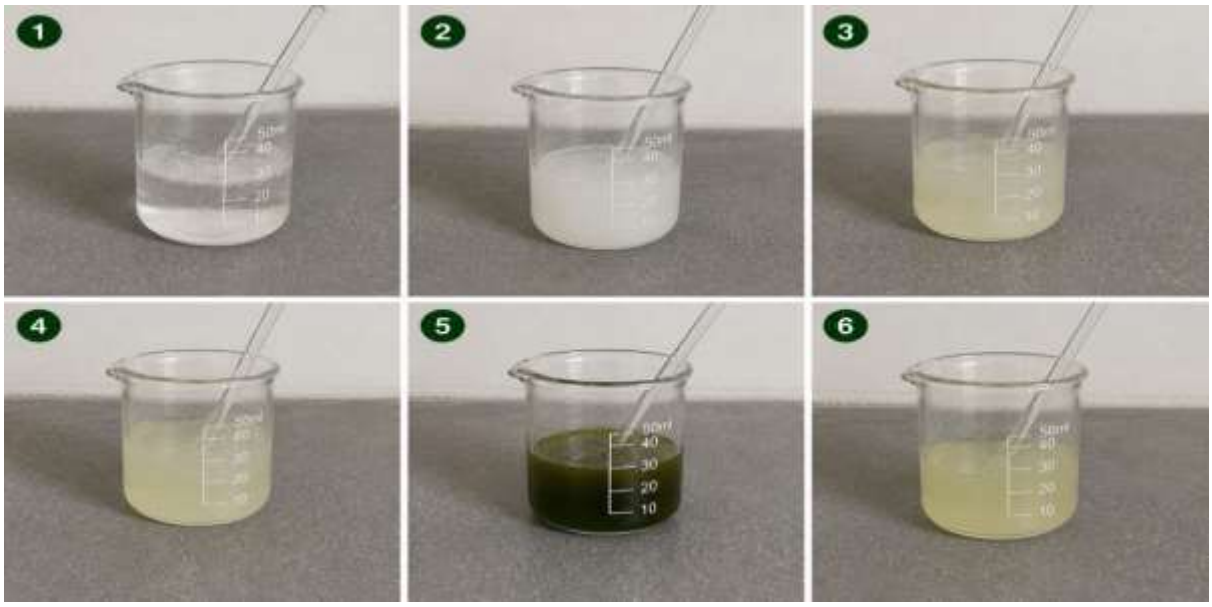


Figure 5: Formulation Of Herbal Gel

6. EVALUATION PARAMETER OF HERAL GEL

6.1 PHYTOCHEMICAL SCREENING OF HERBAL EXTRACT

Phytochemical screening was carried out to identify the presence of bioactive compounds in plant extracts. In this study, tests were performed to detect phenols and flavonoids, which are responsible for antioxidant and antimicrobial activity,

6.1.1. TEST FOR PHENOLS (FERRIC CHLORIDE TEST)

In the Ferric Chloride Test for phenols, the principle was based on the reaction of phenolic compounds with ferric chloride ($FeCl_3$), which produces a colored complex such as blue, green, or violet, For the procedure, 2 ml of the plant extract was taken in a test tube and 2–3 drops of 5% ferric chloride solution were added, The mixture was then shaken gently, The formation of a blue-green or dark green color was observed, which confirmed the presence of phenolic compounds in the extract, (42)

Figure 7: Test Of Phenol

6.1.2. TEST FOR FLAVONOIDS (ALKALINE REAGENT TEST)

In the alkaline reagent test for flavonoids, the principle was based on the reaction of flavonoids with sodium hydroxide (NaOH), which produces a yellow color that disappears upon the addition of dilute acid, For the procedure, 2 ml of the extract was taken in a test tube and a few drops of sodium hydroxide solution were added, After observing the color change, dilute hydrochloric acid (HCl) was added to the mixture, A yellow

color appeared during the test, indicating a positive reaction, The result confirmed the presence of flavonoids in the extracSt,(43)

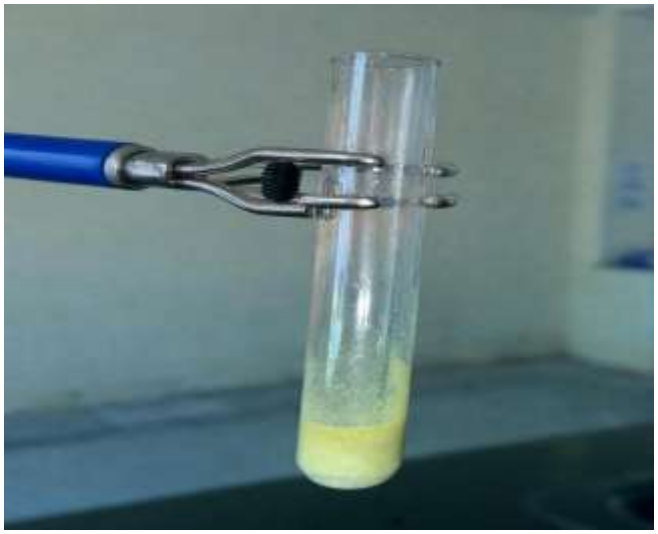


Figure 7: Test For Flavonoid

6.2 EVALUATION PARAMETERS OF HERBAL GEL

6.2.1 PHYSICAL EVALUATION

Physical evaluation of the prepared herbal gel was carried out to assess its appearance, clarity, texture, and overall quality for topical application, A small quantity of the gel was taken on a clean surface or fingertip and observed carefully for its color and appearance, whether clear or opaque.(44)

6.2.2. pH

The pH of the herbal gel was determined to ensure compatibility with the skin and to avoid irritation during application, About 1 g of gel dissolved in 10 ml of distilled water and the pH was measured using a digital pH meter by dipping the electrode into the prepared solution, The reading obtained was recorded carefully, The ideal pH range for topical herbal gel preparations should be between 5.5–7.0 which was considered suitable for skin application.(45)

Figure 8: Determination Of Ph Using Ph Meter

6.2.3 VISCOSITY

Viscosity was measured to determine the thickness and flow behavior of the gel, which influences its spreadability, stability,of application, The gel sample was placed in the container of a viscometer, and an appropriate spindle along with suitable rotational speed was selected, The viscosity reading was then recorded, The gel should exhibit moderate viscosity so that it can be easily applied while maintaining good stability.(46)

Figure 9: Determination of viscosity using viscometer

6.2.4 Spreadability

Spreadability was evaluated to determine the ease with which the gel spreads on the skin surface, It was commonly measured by the glass slide method in which the gel was placed between two glass slides, and a specific weight was applied over the upper slide, The time taken by the upper slide to move a certain distance was recorded, Good spreadability indicates better patient compliance and easy application.(47)

6.2.5 Homogeneity

Homogeneity was evaluated to ensure uniform distribution of all ingredients within the gel formulation, The gel was visually inspected for the presence of lumps, coarse particles, or phase separation, A homogeneous gel should appear smooth, uniform, and free from any visible particulate matter,(48)

6.2.6 Odour

Odour evaluation was performed to determine the acceptability of the gel based on its smell, A small quantity of gel was taken and smelled gently to assess its characteristic odour, The gel should possess a pleasant or characteristic odour without any unpleasant or foul smell that may reduce patient acceptability,(49)

6.2.7 Washability

Washability of the gel was assessed to determine how easily it can be removed from the skin surface after application, The gel was applied on the skin and washed with water, and the ease of removal was observed, A good herbal gel should be easily washable and should not leave greasy or sticky residues on the skin.(50)

6.2.8 Stability

Stability studies are carried out to evaluate whether the herbal gel maintains its physical and chemical properties during storage, The prepared gel was stored under different temperature conditions such as room temperature (25 ± 2°C) and cool temperature/refrigerated condition (4 ± 2°C) for a specified period, The formulation was observed periodically for any changes in color, pH, consistency, odour, and appearance.(51)

6.2.9 Skin Irritation Test

The skin irritation test was performed to ensure the safety of the herbal gel for topical application, A small quantity of gel was applied on the forearm and left undisturbed for about 24 hours, The skin was then observed for any signs of redness, itching, swelling, or irritation, A safe formulation should not produce any visible irritation or adverse reaction on the skin,(52)

6.2.10 Antimicrobial Activity

According to previously published studies, the combination of green tea and aloe vera exhibits significant antimicrobial activity against various microorganisms, Green tea contains catechins and polyphenols, while aloe vera contains saponins and other bioactive compounds that inhibit the growth of bacteria and fungi, Several researchers have reported that herbal formulations containing these extracts produce a clear zone of inhibition against microbial strains, indicating effective antimicrobial properties, Therefore, the formulated herbal gel may help in preventing microbial infections and improving skin health,(53)

6.2.11 Antioxidant Activity

Previous studies have reported that green tea and aloe vera possess strong antioxidant activity due to the presence of phenolic compounds, flavonoids, catechins, and vitamins, Green tea was especially rich in epigallocatechin gallate (EGCG), which acts as a powerful free radical scavenger, Aloe vera also contributes antioxidant effects through its phenolic constituents and vitamins, Published research has shown that formulations containing these herbal extracts demonstrate significant free radical scavenging activity in DPPH assays, Therefore, the formulated herbal gel may help protect the skin from oxidative stress, cellular damage, and premature aging,(54)

7. RESULT AND DISCUSSION

Table 2: Observation Table of Evaluation Parameters & Physiochemical Screening

Sr, No,		Parameters	Results	Discussion
1,	➢	➢ Colour	Greenish brown	Colour indicates presence of herbal ingredients and uniform distribution.
	➢	➢ Appearance	Smooth and transparent gel	Indicates good clarity and acceptable appearance for topical application.
	➢	➢ Texture	Smooth and non-sticky	Shows good consistency and ease of application on the skin.
2,		pH	6.3	Within acceptable skin pH range (5,5–7,0), compatible with skin.
3,		Viscosity	2450 cP	Indicates moderate viscosity suitable for easy application and stability.
4,		Consistency	Smooth and uniform	Shows proper gel formation with good spreadability.
5,		Spreadability	18 sec	Indicates the gel spreads easily with minimum effort.

6,		Homogeneity	No lumps or particles observed	Indicates uniform distribution of ingredients in the gel.
7,		Odour	Pleasant herbal odour	Provides good patient acceptability without foul smell.
8,		Washability	Easily washable with water	Gel can be removed easily without greasy residue.
9,		Stability	No significant change at 25 ± 2°C and 4 ± 2°C	Indicates the gel remains stable without changes in colour, pH, or texture.
10,		Skin Irritation Test	No redness or irritation observed	Indicates the gel was safe for topical application.

8. CONCLUSION

The present study successfully focused on the formulation and evaluation of a herbal gel containing Aloe vera (*Aloe barbadensis Miller*) and green tea (*Camellia sinensis*) extracts for topical application, The increasing demand for natural and safe skincare products has encouraged the development of herbal formulations as alternatives to synthetic preparations,

The formulated gel exhibited satisfactory physicochemical properties such as appropriate pH, good viscosity, smooth consistency, and excellent spreadability, making it suitable for topical use, The gel was found to be homogeneous, easily washable, and showed good extrudability, Stability studies indicated that the formulation remained stable under normal storage conditions without significant changes in its characteristics,

Phytochemical screening confirmed the presence of important bioactive compounds such as phenols and flavonoids, which are responsible for antioxidant and antimicrobial activities, The combination of Aloe vera and green tea showed a synergistic effect, providing multiple benefits including hydration, anti-inflammatory action, protection against oxidative stress, and antimicrobial activity,

The skin irritation test demonstrated that the gel was safe and non-irritating, indicating its suitability for regular use, Overall, the formulated herbal gel can be considered an effective, safe, and economical topical preparation for improving skin health,

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