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Research Article

Formulation And Evaluation of Polyherbal Anti- Microbial Hair Gel

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ABSTRACT

Herbal hair gel formulations are designed for topical application and are particularly effective for addressing scalp issues such as dandruff. Gels are a widely preferred dosage form due to their ease of application, improved patient compliance, and ability to deliver active ingredients directly to the affected area. The ingredients of the hair gel are Guava leaves extract, Aloe-vera extract, Amla juice and Carbopol 940 and triethanolamine which act as antibacterial and antifungal, moisturizer, hair nourishment gelling agent, pH adjuster. Guava leaves are rich in vitamin B and C that help in nourishing hair and also aids hair growth. Guava leaves show antibacterial and antifungal activity on gram positive and gram-negative bacteria. Vitamin C present in amla which is 20 times more than that of orange; which prevents premature graying of hairs, it also provides luster to hair and strength follicles.

INTRODUCTION

Gel formulation is one of the topical formulations and it gives less adverse effects and better absorption through skin as compared to other formulations. When an herb is formulated as gel it gives maximum therapeutic effect and better absorption through skin. Herbal hair gel is a natural and nourishing alternative to conventional hair styling products. Made with carefully selected botanical ingredients, it provides a gentle and effective way to achieve desired hairstyles while

promoting the health of your hair. Hair care is an important aspect of personal grooming and appearance for individuals of all ages and genders. [1] One of the most common hair styling products used worldwide is hair gel. However, most commercially available hair gels contain chemicals that can damage hair and scalp health. Hence, there has been a growing trend towards using natural and herbal products in hair care, including hair gel. In herbal hair gel many types of herbal plants are used such as Guava leaves, Aloe-vera, Amla, Hibiscus flower, Flaxseed, Jasmine flower, Neem leaves etc. Gels are semisolid

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systems with a constrained liquid phase inside a three-dimensional polymeric matrix consisting of organic and inorganic components that have undergone intensive physical or chemical cross-linking. Majority of topical gels are made with organic polymers, such as carbopol 934, which gives appealing, clear, glittering look. These gels nourish and strengthen hair follicles, leading to healthier and stronger hair growth. These gels are also used to control hair-fall, effective against candidiasis and prevent premature graying. [2]

Scalp infection:

Dandruff is a skin condition with Symptoms includes flaking and sometimes mild itchiness cause to the scalp The are many bacteria, Fungus causing scalp infections which leads to further hair problems or skin issues. Candidiasis is a common condition usually affecting the skin or mucous membranes, caused by a fungus called Candida. Malassezia is another fungus that typically appears in people with higher levels of oil production in their skin, as it feeds on lipids.[3] Folliculitis is a common skin issue that causes inflammation and is frequently seen in the general population. Several microbial agents act as causative agents, but Staphylococcus aureus is found in most of patients with Folliculitis. Candida albicans and S.Aureus are opportunistic microbes. [4] The frequency of this infection is more and cause hair problems on regular basis in unhygienic conditions or lower immunity towards them. Many such treatments are available in market but compared to any other treatment, Herbal treatment is always a better option. Even after complete cure, the infection cans cause recurrence. [5]

Gel

Gels as a semisolid system consisting of dispersion made up of either small inorganic particle or large

organic molecule enclosing and interpenetrated by liquid.

Types of Gels-

- Hydrogel
- Organogel
- Xerogel

Why use of Gels?

- Controlled release
- Topical applications
- Non-greasy
- Easy absorption
- Reduced systemic side effects [6]

Herbal Hair Gel

Gels are semi-solid suspensions of small inorganic particles or large organic molecules impregnated with a liquid, consisting of a gelling agent and a liquid component. Ideal hair gel properties include antimicrobial properties, non-stickiness, cost-effectiveness, ease of washing, spreading, and safety. Herbal hair gel is a type of hair gel that is made from natural herbs, plants, and botanicals. These gels are designed to provide a natural and chemical-free alternative to traditional hair gels. Herbal extract used in gel guava leaves, aloe-vera, amla juice. Guava leaves are rich in vitamin B and C that help in nourishing hair and also aids hair growth. Guava leaves show antibacterial and antifungal activity on gram positive and gram-negative bacteria.[7]

Classification of Gel

- Water-based gel
- Alcohol-based gel
- Hybrid gel
- Natural gel



1. **Water-based gel:** Lightweight, non-greasy, and easy to wash out
2. **Alcohol-based gel:** Provides strong hold, but can dry out the hair
3. **Hybrid gel:** Combination of water and alcohol, offering a balance of hold and moisture
4. **Natural gel:** Made from natural ingredients, such as plant extract and essential oils



Fig. no. 1 Guava leaves

Advantages of Herbal Gel-

- Natural Hold and Styling
- Nourishment and Care
- Suitable for daily use
- Stable Complex
- Film Forming Capacity
- Prolonged Germicidal Action
- Adheres to treated surface

Disadvantages of Herbal Gel-

- Reaction triggered by allergies are possible with gels.
- An enzyme found in the skin may denature the gels medication.

Benefits-

- Promotes healthy hair growth: Herbal hair gel can help to stimulate hair growth and strengthen hair follicles.
- Reduce dandruff and itchiness: Can help to soothe and calm the scalp, healthy and vibrant.
- Add shine and luster: Can help shine and luster to hair, leaving it looking healthy and vibrant.
- Protects from environmental damage.
- Antibacterial and Antifungal [8]

Antimicrobial Herbs-

Guava Leaves:

Biological source: It is the dried or fresh Leaves of *Psidium guajava* Linn. Belonging family Myrtaceae.

Chemical constituents: The chemical constituents of guava are Flavonoids (Quercetin, Guaijaverin), Tannins (Ellagic acid), Saponins, Essential oils (Eucalyptol), terpenoids Alkaloids, Phenolic compounds, Vitamin B & C.

Uses:

1. Promotes Hair Growth: Contains antioxidants and flavonoids (like quercetin) that improve blood circulation to the scalp and stimulate hair follicles.
2. Reduces Hair Fall: Strengthens hair roots and prevents breakage due to antimicrobial and anti-inflammatory properties.
3. Controls Dandruff: Antibacterial and antifungal properties help maintain scalp hygiene and reduce dandruff.[9]

Amla:



Fig. no.2 Amla

Biological Source: Dried and fresh fruits of *Phyllanthus emblica* Linn belonging to family *phyllanthaceae*

Chemical constituents: The chemical constituents of amla are vitamin C (ascorbic acid is highly stable in amla), Tannins (Emblicanin A & B, Punigluconin), Flavonoids (Quercetin, kaempferol) Phenolic compounds, gallic acid & alkaloids.

Uses:

1. Strengthens hair roots: Rich in Vitamin C and antioxidants that nourish the scalp
2. Promotes hair growth & hair nourishment
3. Prevents dandruff: Has antimicrobial and anti-inflammatory effects
4. It also used as antifungal and antioxidant [10]

Aloe vera:



Fig. No. 3 Aloe vera

Biological source: Dried juice (latex) and fresh gel obtained from the leaves of *Aloe barbadensis* belonging family *Liliaceae*

Chemical constituents: The chemical constituents of aloe vera are Polysaccharides, Anthraquinones (Aloin, barbaloin), Enzymes (Amylase, catalase, cellulose), Vitamins (A, C, E, B12, folic acid) Minerals (Calcium, magnesium), Saponins, amino acids, lignin, salicylic acid.

Uses:

1. Moisturizes Hair and Scalp: Hydrates dry hair and soothes itchy, flaky scalp.
2. Promotes Hair Growth: Contains enzymes that help stimulate hair follicles and reduce hair fall.
3. Reduces Dandruff: Its antifungal and antibacterial properties help combat dandruff and scalp infections.
4. Adds Shine and Smoothness: Makes hair softer, shinier, and more manageable.
5. Reduces Frizz: Helps tame frizz and flyaways by locking in moisture.
6. Natural Styling Gel: Provides a light hold for natural hairstyles without chemicals.[11]

MATERIALS AND METHOD-

Materials- Guava leaves extract, Aloe vera extract, Amla juice, Carbopol 940, Propylene glycol, Propyl and Methyl paraben, Triethanolamine, Water.

Methods-

Preparation of methanol extract of guava leaf powder:

Phytochemical extract of *Psidium guava* is obtained by immersion extraction method. The methanol extract is prepared by mixing 20 grams of guava leaf powder with 160 ml of methanol and 40 ml of distilled water. This mixture is kept in a dark place to avoid sunlight for 3 days at room temperature. Beakers are used for storage, the clone bottle is sterilized and wrapped in aluminum foil to prevent evaporation. After the 3-day soaking process, the mixtures were filtered with filter paper, and the solvent was allowed to evaporate at 37 °C. 20 g of powder with 180 ml of methanol gives 10 ml of extract.[12]



Fig. No. 4: Extraction of guava leaves

Preparation of Aloe vera extract:

The aloe leaves were cleaned and placed upright in a beaker for 15-20 min to drain out all the yellow color sap present. The pulp from the aloe leaf was removed and collected in beaker and grind it into the mixer to form liquid foam. This liquid was filtered to remove any remaining particles.[13]



Fig. No. 5 Aloe vera extract

Preparation of Amla juice:

The fresh Amla fruit was collected and cut into small pieces. It was crush by using some required amount of water with the help of mixer to form juice. And then filtered through a clean cotton cloth and the Amla Juice was obtained.[14]



Fig. No. 6 Aloe vera extract

Formulation Table-

Table no. 1 Formulation table

Sr. No.	Ingredients	F1	F2
1	Guava leaves extract	1gm	2g
2	Amla juice	1gm	1gm
3	Aloe- vera	1gm	1gm
4	Carbopol	0.45gm	0.45gm
5	Propylene glycol	10.4gm	10.4gm
6	Propyl paraben and methyl paraben	0.1gm	0.1gm
7	Triethanolamine	1-2 drops	1-2 drops
8	Water	QS	QS

Preparation of Gel:

- Weigh required quantity of Carbopol 940 and dispersed in 25 ml of distilled water in beaker.

Keep beaker aside for half an hour to swell Carbopol 940 and then start stirring at 1200 rpm by using mechanical stirrer for 30 min.

- Keep beaker aside for half an hour to swell Carbopol 940 and then start stirring at 1200 rpm by using mechanical stirrer for 30 min.
- Solution A: Take 1g or 2.5g of Guava extract and add in 5 ml of Propylene glycol in one beaker and stirred properly.
- Solution B: Add Aloe juice, Amla juice, methyl Paraben and Propyl Paraben in 5 ml propylene glycol in another beaker.
- Disperse Solution A and B in Carbopol 940 with constant stirring.
- Finally add remaining ml of distilled water to make up 50 ml of formulation and add Triethanolamine drop wise to the formulation until pH become neutral and gel get required consistency.[15]

Evaluation Parameters:

1. **Organoleptic properties:** Color, Odor, Appearance and homogeneity observed by physical perception
2. **pH Determination:**
 - 1gm of prepared gel taken in 100 ml of volumetric flask.
 - Make up volume to 100ml with distilled water and sonicate for 10 minutes.
 - pH was measured by using digital pH meter.
3. **Determination of viscosity:** Viscosity of gel was determined using Brookfield Viscometer at 25°C Celsius with rotation at 12 rpm.
4. **Skin Irritating:** Apply a small quantity of gel on the dorsal part of the hand, check for irritation and redness.
5. **Washability:** Apply on skin, after few minutes wash with normal water and observe for clean and clear skin.

Spreadability:

1. Area of extent to which topical application spread on skin is called as spread ability.
2. First take two horizontal glass plates.
3. 2gm sample place between two plates and 1kg weight applied on it.
4. After 5 min seen the gel spread over the plates and measure the Spreadability of gel over the glass.

$$S=M.L/T$$

Where, S= Spreadability

M= Weight placed on the slide

L=diameter of circle in cm

T=time in seconds [16,17]

Determination of anti-microbial activity:

Disk diffusion assay:

The Kirby-Bauer disk diffusion method was used to assess the synthetic formulations' antibacterial potential. In short, 50 µL (1 mg/mL) of synthesized compounds were put onto each sterile disk (Himedia Pvt. Ltd., Mumbai) and then dried. The sterile, solidified agar medium was then spread with 24-hour-old microbial culture inoculums and the corresponding standards (1 mg/mL) on over of each disk. After one hour of diffusion in the refrigerator, the plates were moved to an incubator set at 37°C for 24 to 48 hours. Following incubation, the zone scale (Himedia Pvt. Ltd., Mumbai) was used to measure the zones surrounding the discs.[18]

RESULTS AND DISCUSSION-

Table no. 2 Result of Organoleptic Properties

Sr. No.	Properties	F1	F2
1	Color	Yellowish-brownish	Yellowish-brownish
2	Oduor	Pleasant	pleasant
3	Appearance	Smooth	Smooth
4	Homogeneity	Good	Good



Table no. 3 Result of Organoleptic Properties

Property	F1	F2	observation
pH	5.2	6.5	Neutral
Spreadability	7cm/sec	6cm/sec	Spreadable
Skin irritation	Non irritant	Non irritant	-
Viscosity	3500cP	4020cP	Viscous
Washability	Easily washable	Easily washable	-

Table no. 4 Result of Antimicrobial activity

Formulation	C. albicans	S. aureus
F2	+	++
Streptomycin	+++	+++

+= < 5 mm, ++ = >5 & <10 mm, +++ = >10 & < 18 mm, NZ=No zone, NA= Not applicable

CONCLUSION

Using herbal elements such as guava leaves, Aloe-vera, Amla juice the two formulations were made and formulation F2 is more efficient than formulation F1 after performing various evaluation parameters. The antimicrobial activity has been tested successfully and the current study has offered experimental support for the formulation of poly-herbal antimicrobial hair gel ability to prevent microbial-induced scalp conditions. In conclusion, polyherbal hair gel holds promise as a natural and effective option for individuals seeking an herbal-based solution for hair care.

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