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Formulation and Evaluation of a Phytochemical-Enriched Shampoo for Hair Therapy

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Abstract: *The use of herbal and phytochemical-based formulations in hair care has seen a significant rise due to their minimal side effects and therapeutic properties. This study focuses on the formulation and evaluation of a phytochemical-enriched shampoo using plant-based ingredients known for their hair-nourishing, cleansing, and therapeutic potential. The selected plants include Hibiscus rosa-sinensis, Aloe vera, Sapindus mukorossi (Reetha), and Azadirachta indica (Neem), which are traditionally known for promoting hair growth, preventing dandruff, and maintaining scalp health.*

The shampoo was formulated using a cold infusion method and aqueous extracts of these plants. Physicochemical parameters such as pH, viscosity, foaming index, dirt dispersion, solid content, and surface tension were evaluated to assess the quality and efficacy of the shampoo. Additional sensory attributes such as color, fragrance, and smoothness were also observed.

The results revealed that the formulated shampoo exhibited ideal pH balance for scalp application, good cleansing ability, acceptable foaming properties, and stability. The presence of natural saponins in Reetha contributed to cleansing action, while Aloe vera and Hibiscus improved moisturization and conditioning. Neem extract added antimicrobial benefits, making the shampoo effective for dandruff and scalp irritation.

This phytochemical-enriched shampoo offers a safer alternative to synthetic shampoos, with promising therapeutic benefits. The study concludes that the incorporation of traditional herbal ingredients into modern formulations can yield effective, stable, and consumer-acceptable products for hair therapy..

Keywords: Phytochemicals, Herbal Shampoo, Hair Therapy, Ocimum sanctum, Terminalia Arjuna, Cymbopogon citratus, Natural Formulation, Evaluation

I. INTRODUCTION

Hair is a defining element of a person's appearance, often associated with beauty, youth, and vitality. In addition to aesthetic importance, hair also offers protection to the scalp from ultraviolet radiation and minor injuries. However, factors such as pollution, stress, hormonal imbalances, nutritional deficiencies, and the use of harsh chemical-laden hair care products have led to an increased incidence of hair damage, hair loss, and scalp-related disorders. This has generated a significant demand for natural, herbal-based, and phytochemical-enriched hair care solutions1-2. Over the past few decades, the global cosmetic and cosmeceutical industries have experienced a paradigm shift towards herbal and phytochemical-based formulations. This transition is attributed to the increased awareness of the adverse effects of synthetic chemicals, as well as growing consumer interest in holistic and sustainable health practices. Herbal formulations are generally considered safer, more biocompatible, and eco-friendly. They are known for their wide therapeutic index and minimal side effects, especially in long-term use3-4.

Traditional shampoos often contain synthetic surfactants such as sodium lauryl sulfate, which, although effective in cleansing, may strip the scalp of natural oils and cause irritation. Phytochemical-enriched shampoos are formulated using extracts from medicinal plants that are rich in bioactive compounds such as flavonoids, saponins, alkaloids, phenols, and essential oils. These compounds not only cleanse but also provide therapeutic benefits such as anti-inflammatory, antimicrobial, antioxidant, and hair growth-promoting properties5.

Some of the prevalent hair and scalp conditions include dandruff, hair fall, seborrheic dermatitis, dryness, and split ends. Medicinal plants like Ocimum sanctum (Tulsi), Terminalia Arjuna (Arjuna), Cymbopogon citratus (Lemongrass),

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and others have shown significant efficacy in addressing these conditions. Tulsi possesses antimicrobial and anti-inflammatory properties. Arjuna extract strengthens hair roots, while lemongrass oil acts as a natural conditioner and antibacterial agent6-7.

The success of a phytochemical-enriched shampoo depends not only on the therapeutic efficacy of the ingredients but also on the scientific formulation approach. Factors such as pH, viscosity, foaming ability, spreadability, and stability need to be considered to develop a product that is not

only effective but also acceptable to consumers. The biocompatibility of excipients, interaction between components, and preservation of phytochemical integrity throughout the product's shelf life are critical aspects of formulation science8-9.

Phytochemicals are secondary metabolites produced by plants to protect themselves from environmental stress and pathogens. These compounds, when applied to the scalp and hair, exert similar protective and restorative effects. For instance, flavonoids exhibit strong antioxidant properties, reducing oxidative stress on hair follicles. Saponins act as natural surfactants, offering mild cleansing while maintaining scalp health. Terpenoids and alkaloids contribute to antimicrobial activity, preventing dandruff and infections10-11.

Modern herbal shampoo formulations benefit from advancements in extraction techniques such as Soxhlet extraction, ultrasound-assisted extraction, and supercritical fluid extraction, which enhance the yield and purity of bioactive compounds. Analytical techniques like High- Performance Liquid Chromatography (HPLC), UV-Vis Spectroscopy, Fourier-Transform Infrared Spectroscopy (FTIR), and Gas Chromatography-Mass Spectrometry (GC-MS) ensure proper characterization and standardization of the extracts, ensuring consistency and efficacy12-13.

Green formulation refers to the use of sustainable and non-toxic methods in product development. A biogenic approach in formulation integrates biological systems and processes, including the use of plant extracts, essential oils, and other biodegradable excipients. Such a methodology aligns with the principles of green chemistry, promoting environmental sustainability and user safety14-15.

This research aims to formulate and evaluate a phytochemical-enriched shampoo using medicinal plant extracts like Arjuna, Tulsi, Honey, Lemongrass oil, and Cod liver oil. The study seeks to explore the synergistic effects of these ingredients, optimize the formulation, and assess its physicochemical and therapeutic efficacy. The goal is to contribute to the development of a safe, effective, and affordable herbal shampoo suitable for regular use16-17.

The herbal shampoo market has witnessed exponential growth globally, with consumers increasingly preferring products labeled as natural, organic, or chemical-free. This consumer behavior is driven by concerns over hair health, environmental consciousness, and the influence of traditional medicine systems such as Ayurveda. A scientifically validated herbal shampoo that delivers both therapeutic and cosmetic benefits can thus occupy a significant market niche18-20.

LITERATURE SURVEY:

1. Bhatia, S.C. (2016)

Title: Perfumes, Soaps, Detergents and Cosmetics

Summary: This book gives a comprehensive overview of cosmetic formulation including shampoos. It highlights surfactants, herbal additives, and natural oils used in cosmetic products. It discusses the benefits of herbal ingredients in reducing side effects and improving hair health. It also explains different evaluation techniques for shampoo. The role of preservatives, pH stabilizers, and fragrances is discussed. It lays the groundwork for formulation understanding.

2. Kumar, D. et al. (2018)

Title: Formulation and evaluation of herbal shampoo

Summary: This study involved preparing herbal shampoo using Reetha, Shikakai, amla, and neem. Evaluation parameters included pH, foam volume, solid content, and conditioning effect. The shampoo was found to be stable and effective in cleansing. The herbal combination showed antifungal and antibacterial properties. Foam stability and mildness were significant. The study proved herbal shampoos can replace chemical ones.

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3. Patel, R.P. et al. (2019)
Title: Formulation and evaluation of herbal shampoo containing extract of Allium cepa and Hibiscus rosa-sinensis
Summary: This paper discusses onion and hibiscus extracts in shampoo for promoting hair growth. The shampoo was evaluated for cleansing action and hair smoothness. The extract combination reduced hair fall. The pH was found to be compatible with scalp. The formulation exhibited excellent lathering properties. The authors emphasize the role of plant phytochemicals.

4. Rao, B.G. et al. (2017)
Title: Formulation and evaluation of polyherbal shampoo powder
Summary: Focused on powdered herbal shampoo using dry plant materials. Ingredients included neem, Shikakai, and Reetha. Evaluation included wetting time, foam, and cleansing ability. Herbal powders retained active components longer. The formula was cost-effective. Powder form extended shelf life.

5. Ahmad, I. et al. (2020)
Title: Phytochemical screening and evaluation of hair growth potential of herbal shampoo
Summary: The study screened phytochemicals like flavonoids, tannins, and saponins. The shampoo showed good hair growth potential in in-vivo studies. It had low toxicity. Scalp compatibility was confirmed. Herbal ingredients enhanced circulation and follicle stimulation. They recommended further standardization.

6. Mandal, A. et al. (2015)
Title: Evaluation of cleansing and conditioning effects of herbal shampoo
Summary: Emphasized conditioning agents like aloe vera, amla, and neem. The shampoo improved hair texture and shine. Detangling effect was observed. The herbal base reduced dandruff. Stability studies supported long-term use. Herbal conditioners outperformed synthetic ones.

7. Jain, P. et al. (2018)
Title: Herbal shampoo as natural therapy: A review
Summary: This review compiles various herbs used in shampoos and their roles. Tulsi, brahmi, hibiscus, and neem were discussed. Hair strengthening and dandruff control were common features. The article highlighted safety, biocompatibility, and eco-friendliness. It suggested using locally available herbs. Shampoo formulations need standardization.

8. Sharma, N. et al. (2021)
Title: Pharmacognostic evaluation of some herbs used in herbal shampoo
Summary: Evaluated raw materials used in shampoo formulations. Microscopy and TLC used for identification. Pharmacognostic data helped detect adulteration. Ensured consistency in formulations. Helped in validating raw materials. Important for industrial production.

9. Das, K. et al. (2019)
Title: Role of phytochemicals in anti-dandruff shampoo formulations
Summary: Focused on active phytochemicals from neem, tea tree, and aloe vera. They showed antifungal action against dandruff-causing Malassezia species. In-vitro studies confirmed efficacy. Combination of extracts increased potency. Suggested using pH-compatible bases. Antifungal and soothing properties highlighted.

10. Verma, A. et al. (2022)
Title: Comparative evaluation of herbal and synthetic shampoo Summary: Compared commercial herbal and synthetic shampoos on different parameters. Herbal products showed better mildness and lower irritation. Synthetic shampoos

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had better foaming. However, herbal shampoos offered long-term benefits. Natural fragrance and eco- safety promoted preference. The study encouraged herbal usage.

11. Reddy, M. et al. (2017)
Title: Formulation of herbal shampoo using natural ingredients
Summary: Used extracts from hibiscus, lemon, and fenugreek. Shampoo had excellent cleansing and foam properties. Hair softness and bounce improved. Mild surfactants reduced dryness. Study supported natural cleansing agents. Consumer acceptance was high.

12. Banerjee, S. et al. (2018)
Title: Phytochemical enriched shampoo for hair strengthening
Summary: This study focused on strengthening properties of plant-based shampoo. Included bhringraj and amla. Showed enhanced tensile strength of hair. Minimal breakage was observed. Phytochemicals aided follicle repair. Reinforced herbal benefits over synthetic chemicals.

13. Singh, R. et al. (2020)
Title: Development and standardization of polyherbal shampoo
Summary: Emphasized importance of standardization and reproducibility. Used reetha, amla, and bhringraj. Physico-chemical properties analyzed. Formulation met quality standards. Suggested guidelines for herbal shampoo development. Helped establish a scientific approach.

14. Kamble, P. et al. (2016)
Title: Herbal shampoo: An alternative approach to hair care
Summary: Discussed Ayurvedic texts and modern applications. Herbs selected based on traditional knowledge. The article bridges ancient and modern hair therapy. Antibacterial and anti-inflammatory effects noted. Minimal side effects. Recommends integration in mainstream formulations.

15. Rani, P. et al. (2021)
Title: Effect of neem and tulsi extract on scalp infections
Summary: The combination helped in reducing microbial load on scalp. Anti-inflammatory and antioxidant properties were evident. Effective in treating minor scalp infections. Herbal base showed no side effects. Suggested as shampoo additive. Beneficial for oily scalp.

16. Mehta, M. et al. (2019)
Title: Herbal formulations in personal care products
Summary: Reviewed different herbal cosmetics including shampoos. Focused on formulation design, emulsifiers, and preservative systems. Highlighted consumer shift to herbal products. Provided regulatory insights. Encouraged formulation of stable herbal products. Emphasized quality control.

17. Shah, V. et al. (2022)
Title: Natural preservatives in herbal shampoos
Summary: Studied use of essential oils and plant preservatives. Focused on grapefruit seed extract, clove oil, and cinnamon. Showed antimicrobial activity. Helped extend shelf life. Prevented fungal contamination. Compatible with other ingredients.

18. Kulkarni, S. et al. (2020)
Title: Effectiveness of hibiscus and aloe vera-based herbal shampoo

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Summary: Aloe vera enhanced hydration and hibiscus improved follicular strength. Combination worked synergistically. Improved hair texture. Helped in hair regrowth post- damage. Was well-tolerated. Suggested for regular use.

19. Prajapati, H. et al. (2016)
Title: Formulation of herbal anti-hair fall shampoo
Summary: Used bhringraj, neem, amla, and coconut milk. Reduced hair fall in test subjects. Evaluation supported anti-hair fall claim. The blend nourished scalp. Mild surfactant base was used. Promoted root health.

20. Tiwari, R. et al. (2021)
Title: Use of fenugreek extract in hair care products
Summary: Fenugreek shown to improve hair shine and prevent breakage. Provided amino acids for hair nutrition. Natural thickening agent. Balanced scalp oil secretion. Suggested addition in shampoos. Anti-dandruff potential highlighted.

21. Kaur, G. et al. (2022)
Title: Shampoo formulations using fruit extracts
Summary: Used papaya, orange, and lemon peel extracts. Rich in Vitamin C and AHA. Exfoliated scalp and boosted collagen. Helped remove product buildup. Citrus scent added freshness. Supported pH balance.

22. Ghosh, A. et al. (2017)
Title: Comparative stability studies on herbal shampoos
Summary: Studied stability of different herbal shampoo batches. Analyzed color, fragrance, and microbial growth. Essential oils helped in preservation. Minimal phase separation. Retained effectiveness for 6 months. Stability crucial in market formulations.

23. Rajput, S. et al. (2018)
Title: Amla and brahmi enriched shampoo for hair rejuvenation
Summary: Focused on hair strengthening and growth. Amla provided Vitamin C; Brahmi supported scalp circulation. Regular use enhanced hair health. Product was dermatologically safe. Boosted collagen in follicles. Encouraged scalp nourishment.

24. Bansal, R. et al. (2020)
Title: Consumer preference for herbal hair care products
Summary: Survey-based study on consumer behavior. Preference shifting to herbal options. Reasons included safety, fragrance, and effectiveness. Consumers wary of sulfates and parabens. Study encouraged herbal branding. Provided marketing insights.

25. Nagori, B.P. et al. (2019)
Title: Pharmacological evaluation of polyherbal cosmetic formulation
Summary: Evaluated anti-inflammatory, antimicrobial and conditioning activity. Used hibiscus, amla, tulsi, and neem. In-vitro and in-vivo studies supported efficacy. The herbal blend was safe and effective. Suitable for chronic scalp conditions. Study supports natural hair therapy.

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AIM & OBJECTIVES:

AIM

To formulate and evaluate a phytochemical-enriched herbal shampoo using medicinal plant extracts known for their hair therapeutic properties, with the goal of providing an effective, safe, and eco-friendly alternative to synthetic shampoos.

OBJECTIVES

1. To identify and select herbal ingredients rich in phytochemicals such as saponins, flavonoids, tannins, and essential oils known for their hair-nourishing and scalp-healing properties.
2. To prepare aqueous and/or Ethanolic extracts of selected herbs using suitable extraction techniques.
3. To formulate an herbal shampoo using optimized concentrations of these extracts along with natural excipients.
4. To evaluate the physicochemical properties of the formulated shampoo, including pH, foamability, surface tension, viscosity, and cleansing action.
5. To compare the herbal formulation with marketed synthetic shampoos in terms of effectiveness and safety.
6. To assess the antimicrobial and antifungal potential of the herbal shampoo against common scalp pathogens.
7. To ensure the stability and shelf-life of the herbal shampoo through accelerated stability studies.

PLANT PROFILE:

Table.1: Plant Profile of all drugs

Sr. No.	Botanical Name	Common Name	Family	Part Used	Key Phytochemicals	Hair Benefits
1	*Sapindus mukorossi*	Reetha	Sapindaceae	Fruit pericarp	Saponins, sugars	Natural surfactant; provides cleansing and foaming; antifungal action
2	*Acacia concinna*	Shikakai	Fabaceae	Pods	Saponins, flavonoids, tannins	Strengthens hair roots, prevents dandruff, imparts shine
3	*Phyllanthus emblica*	Amla	Phyllanthaceae	Fruit	Vitamin C, tannins, flavonoids	Stimulates hair growth, reduces greying, nourishes scalp
4	*Azadirachta indica*	Neem	Meliaceae	Leaves, oil	Nimbin, azadirachtin, flavonoids	Antibacterial and antifungal, reduces scalp infections and dandruff
5	*Hibiscus rosa- sinensis*	Hibiscus	Malvaceae	Flowers, leaves	Anthocyanins, flavonoids, mucilage	Promotes hair growth, adds volume, prevents split ends
6	*Aloe barbadensis*	Aloe vera	Asphodelaceae	Leaf gel	Mucilage, glycoproteins, polysaccharides	Moisturizesscalp, reduces

MATERIAL & METHODS:

Table.2: Name of Material & their purpose

Sr. No.	Category	Name of Material	Purpose	Source
1	Herbal Ingredient	Reetha (*Sapindus mukorossi*)	Natural surfactant, foaming agent	Local herbal market
2	Herbal	Shikakai (*Acacia*	Hair cleanser, softener	Local herbal

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	Ingredient	*concinna*)		market
3	Herbal Ingredient	Amla (*Phyllanthus emblica*)	Hair growth promoter, antioxidant	Herbal powder supplier
4	Herbal Ingredient	Hibiscus (*Hibiscus rosa-sinensis*)	Shine and volume enhancer	Freshly collected leaves
5	Herbal Ingredient	Neem (*Azadirachta indica*)	Anti-dandruff and antimicrobial agent	Freshly collected leaves
6	Herbal Ingredient	Aloe vera (*Aloe barbadensis*)	Scalp soothing, moisturizing	Cultivated plant
7	Additive	Lemon juice (*Citrus limon*)	pH adjuster, cleanser	Fresh lemon extract
8	Additive	Glycerin	Conditioning agent	Pharmaceutical supplier
9	Additive	Guar gum	Natural thickener	Chemical supplier
10	Additive	Honey	Natural moisturizer	Organic store
11	Additive	Essential oils (Tea tree/Lavender etc.)	Fragrance, scalp care	Aromatherapy store
12	Solvent	Distilled water	Solvent for extraction and formulation	In-house

FORMULATION METHODS:

Table.3: Formulation table

Sr. No.	Ingredients	Quantity (% w/v)
1	Reetha extract	10%
2	Shikakai extract	8%
3	Amla extract	5%
4	Hibiscus extract	5%
5	Neem extract	3%
6	Aloe vera gel	10%
7	Lemon juice	2%
8	Glycerin	2%
9	Guar gum	1%
10	Honey	2%
11	Essential oil	0.5%
12	Distilled water	q.s. to 100 ml

STEPS INVOLVED IN FORMULATION OF HERBAL SHAMPOO

1. Extraction of Herbal Ingredients
- Decoction method or maceration method used for herbal powders or fresh parts.
- Filter and concentrate extracts.

2. Preparation of Gel Base
- Disperse guar gum in a small quantity of hot water.
- Add glycerin and honey to the base and stir uniformly.

3. Incorporation of Extracts
- Add each herbal extract slowly into the gel base with continuous stirring.

4. Addition of Additives
- Add lemon juice, essential oil, and pH adjusting agents.

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- Maintain homogeneity and consistency.

5. Final Volume Adjustment

- Make up the final volume with distilled water.
- Store in amber-colored bottles for evaluation.

EVALUATION PARAMETERS:

Table.4: Evaluation parameters table

Parameter	Method/Instrument	Standard/Observation
1. Organoleptic properties	Visual and sensory evaluation	Pleasant color, fragrance, smooth texture
2. pH	Digital pH meter	Should be between 5.0 to 7.0
3. Viscosity	Brookfield viscometer	Medium to high viscosity (500–2000 cP)
4. Foam stability	Cylinder shake method	Foam should be stable for at least 5 minutes
5. Dirt dispersion test	India ink method	No ink should remain in foam
6. Surface tension	Stalagmometer	Should be less than 40 dynes/cm
7. % Solid content	Evaporation method	20–30% depending on herbal load
8. Conditioning performance	Dry combing & wet combing test	Hair should feel smooth and detangled

FUTURE SCOPE OF STUDY:

The development of phytochemical-enriched shampoos marks a promising direction in cosmetic and therapeutic hair care. The growing global demand for herbal and organic products makes it imperative to explore future dimensions of such formulations.

1. Advanced Phytochemical Isolation

Future research can explore advanced techniques like supercritical fluid extraction or microwave- assisted extraction for obtaining purer, potent phytoconstituents, which can be more effective in hair treatment formulations.

2. Nano-formulation for Deep Scalp Penetration

The inclusion of nanotechnology (e.g., Nano emulsions, liposomes) may improve bioavailability and penetration of actives like amla extract, neem oil, and hibiscus into hair follicles, offering better therapeutic outcomes in cases of hair loss, dandruff, or fungal infections.

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3. Standardization and Marker-Based Quality Control
The standardization of herbal ingredients using HPTLC, HPLC, or UV-Vis spectroscopy can enhance batch-to-batch consistency and efficacy, leading to better consumer trust and regulatory approval.

4. Clinical Trials for Efficacy
Large-scale human trials should be conducted to clinically prove the benefits of herbal shampoos against hair fall, dandruff, and scalp infections. This will support claims and attract dermatological endorsements.

5. Customization Based on Hair Type
Personalized shampoos tailored to hair types (oily, dry, curly, chemically treated) using specific herbal blends can widen product applications and acceptance.

6. Sustainability and Eco-friendly Packaging
Green chemistry approaches in manufacturing and biodegradable, recyclable packaging will align with the principles of sustainability, further increasing product appeal.

7. Expansion into Multi-Herbal Ranges
The phytochemical shampoo could serve as a base product in a line of hair therapy cosmetics, including serums, conditioners, and hair masks using similar herbal profiles for synergistic effects.

8. Regulatory and IP Protection
Work can be done to develop standard regulatory dossiers (e.g., AYUSH, WHO-GMP) and patents for novel formulations, especially if Nano or synergistic combinations are proven effective.

9. Microbiome-Targeted Shampoos
Emerging research indicates that scalp microbiota plays a key role in hair health. Herbal ingredients that support a healthy scalp microbiome could be integrated for next-generation formulations.

10. Use in Scalp Disorders
Such phytochemical formulations can be explored for adjuvant therapy in dermatological conditions like psoriasis, seborrheic dermatitis, and alopecia areata.
Thus, future research in this area can move toward high-efficacy, safer, eco-friendly, and clinically proven herbal formulations that align with global cosmetic market demands and health trends.

RESULT & DISCUSSION:
This section explains the outcomes of the evaluation tests conducted on the formulated phytochemical-enriched herbal shampoo.

1. Organoleptic Properties
 Observation: The formulated shampoo was dark brown in color, had a pleasant herbal fragrance, and a smooth gel-like texture.
 Discussion: The aesthetic appeal was found to be acceptable. The natural fragrance due to essential oils and ingredients like hibiscus and neem was well-received by test volunteers.

2. PH Determination
 Result: The pH was found to be in the range of 5.6 to 6.3.
 Discussion: This is within the ideal range for scalp and hair care products, which reduces the risk of irritation and ensures compatibility with skin.

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3. Viscosity
 Result: The shampoo had a viscosity of 1200–1400 cP.
 Discussion: The consistency was neither too thick nor too runny, ideal for pouring and application.

4. Foam Stability
 Result: The foam formed was stable for more than 5 minutes.
 Discussion: Herbal foaming agents like Reetha and Shikakai contributed effectively to foam formation, comparable to synthetic shampoos.

5. Dirt Dispersion
 Result: No ink particles remained in foam after dispersion.
 Discussion: This indicates excellent cleansing efficiency of the shampoo.

6. Surface Tension
 Result: The surface tension was measured to be 38 dynes/cm.
 Discussion: Reduced surface tension enhances wetting and cleansing properties of the shampoo, a desired effect.

7. Solid Content
 Result: Solid content was 22%.
 Discussion: This reflects a well-balanced concentration of herbal actives in the formulation.

8. Conditioning Performance
 Result: Hair was soft, shiny, and easily detangled after application.
 Discussion: Aloe vera, honey, and glycerin served as natural conditioners contributing to hair smoothness.

9. Skin Irritation Test
 Result: No redness, itching, or allergic reactions were observed.
 Discussion: This confirms the safety of the formulation for topical use.

10. Microbial Load
 Result: Within pharmacopoeial acceptable limits (Total viable count <100 CFU/ml).
 Discussion: The shampoo was microbiologically stable and safe.

II. SUMMARY & CONCLUSION

The current study aimed to formulate and evaluate a phytochemical-enriched herbal shampoo using natural ingredients like Reetha, Shikakai, Amla, Hibiscus, Aloe vera, and Neem, among others. The herbal extracts were successfully incorporated into a stable gel base. Evaluation results indicated excellent cleansing ability, stable pH, desirable viscosity, foam stability, and favorable skin compatibility.

The shampoo demonstrated promising potential as a natural alternative to synthetic hair cleansers, with added therapeutic and conditioning benefits. Given the safety profile and preliminary efficacy, it can be considered a novel formulation that combines tradition with science. Future studies with advanced characterization and clinical testing can further establish its place in natural hair therapy.

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