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Review on Formulation and Evaluation of Herbal Multipurpose Hair Mask

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Abstract: Hair care has become a significant aspect of personal health and cosmetic science due to increasing exposure to environmental pollutants, stress, and chemical treatments. Multipurpose herbal hair masks have emerged as effective alternatives to synthetic formulations, offering benefits such as nourishment, conditioning, dandruff control, and hair growth promotion. This review focuses on the formulation and evaluation of a multipurpose herbal hair mask using natural ingredients like *Emblica officinalis*, *Azadirachta indica*, *Trigonella foenum-graecum*, and *Hibiscus rosa-sinensis*. Various preparation techniques and evaluation parameters including organoleptic, physicochemical, phytochemical, microbiological, and stability studies are discussed in detail. The review highlights the importance of herbal ingredients and their synergistic effects in improving hair health while minimizing adverse effects.

Keywords: *Herbal Hair Mask, Phytochemical Evaluation, Cosmetic Formulation, Hair Care, Stability Studies.*

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I. INTRODUCTION

Hair plays a crucial role in enhancing an individual's appearance and self-confidence, making its care an important aspect of personal grooming and cosmetic science. In recent years, the prevalence of hair-related problems such as dandruff, hair fall, dryness, split ends, and premature greying has increased significantly due to factors like environmental pollution, stress, poor dietary habits, and excessive use of chemical-based hair products. Conventional hair care formulations, including shampoos and conditioners, often contain synthetic ingredients such as sulfates, parabens, and silicones, which may provide temporary benefits but can lead to long-term damage to hair structure and scalp health [1,2].

The growing awareness regarding the adverse effects of synthetic chemicals has led to a shift towards herbal and natural cosmetic products. Herbal formulations are considered safer, biodegradable, and more compatible with the human body due to their natural origin and minimal side effects. Among these, herbal hair masks have gained popularity as they provide deep conditioning and nourishment by delivering essential nutrients directly to the hair shaft and scalp. Unlike regular conditioners, hair masks remain in contact with the hair for a longer duration, allowing better penetration of active constituents and improved therapeutic effects [3].

Multipurpose hair masks are particularly advantageous as they combine several herbal ingredients to address multiple hair concerns simultaneously, such as strengthening hair roots, reducing dandruff, improving texture, and promoting hair growth. Ingredients like *Emblica officinalis* (amla), *Azadirachta indica* (neem), *Trigonella foenum-graecum* (fenugreek), and *Hibiscus rosa-sinensis* (hibiscus) are widely used due to their rich phytochemical composition, including vitamins, proteins, flavonoids, and antioxidants. These bioactive compounds contribute to improved scalp health, enhanced hair strength, and protection against oxidative stress [4,5].

Therefore, the formulation and evaluation of a multipurpose herbal hair mask is an important area of research in cosmetic science. It not only provides an effective alternative to synthetic products but also supports the development of safe, economical, and eco-friendly hair care solutions.

- *Skin and Hair*

The skin and hair form an integrated biological system in which the condition of the scalp directly influences the health, growth, and appearance of hair. The scalp is a specialized region of the skin containing a high density of hair follicles, sebaceous glands, and sweat glands. Structurally, the skin consists of three primary layers: epidermis, dermis, and hypodermis. The epidermis acts as a protective barrier,

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while the dermis contains hair follicles, blood vessels, and connective tissue that support hair growth. Proper functioning of these layers is essential for maintaining scalp health and preventing conditions such as dryness, irritation, and microbial infections [6,7].

Hair is a keratinized filament produced by hair follicles located in the dermis. Each hair strand is composed of three layers: the cuticle (outer protective layer), cortex (responsible for strength, elasticity, and color), and medulla (inner core, sometimes absent in fine hair). The cuticle consists of overlapping cells that protect the inner layers from mechanical and chemical damage. When the cuticle is damaged due to environmental stress or chemical exposure, the hair becomes rough, dry, and prone to breakage. Therefore, maintaining the integrity of the hair shaft is a primary objective of hair care formulations such as hair masks [7,8].

The hair growth cycle consists of three phases: anagen (growth phase), catagen (transitional phase), and telogen (resting phase). Disruption in this cycle due to hormonal imbalance, nutritional deficiencies, or scalp disorders can lead to excessive hair fall and thinning. The scalp environment, including pH, sebum production, and microbial flora, plays a significant role in regulating this cycle. A healthy scalp typically has a slightly acidic pH (around 5.5), which helps maintain the protective barrier and prevents microbial overgrowth. Hair masks are often formulated to maintain or restore this pH balance, thereby supporting optimal scalp conditions [8,2].

Sebaceous glands present in the scalp secrete sebum, a natural oily substance that lubricates and protects the hair shaft. However, excessive sebum production can lead to greasy hair and dandruff, while insufficient secretion results in dryness and brittleness. Hair masks formulated with herbal ingredients help regulate sebum production and provide essential nutrients to both scalp and hair. Ingredients such as aloe vera and neem exhibit antimicrobial properties that help control dandruff-causing organisms, while others like coconut and fenugreek provide nourishment and hydration [2,3].

Another important aspect of scalp and hair health is oxidative stress caused by environmental pollutants, UV radiation, and chemical treatments. Free radicals generated under these conditions can damage hair proteins and lipids, leading to weakened hair structure and loss of shine. Herbal ingredients rich in antioxidants, such as amla and hibiscus, help neutralize free radicals and protect the hair from oxidative damage. This highlights the importance of incorporating antioxidant-rich components in multipurpose hair masks [3,1].

In the context of hair mask application, the interaction between the formulation and the scalp-hair system is crucial. Hair masks are designed to remain in contact with the hair and scalp for an extended period, allowing active ingredients to penetrate deeply into the hair shaft and follicular openings. This prolonged contact enhances the delivery of nutrients, improves hydration, and restores damaged hair structures. Additionally, fine particle size achieved through proper grinding and sieving improves adherence and uniform application of the mask on the scalp [7,1].

Thus, understanding the physiology of skin and hair is essential for designing effective multipurpose hair masks. A well-formulated hair mask should not only improve the physical appearance of hair but also maintain scalp health, regulate sebum production, support the hair growth cycle, and protect against environmental damage.

- *Hair Mask Use*

Hair masks are specialized cosmetic formulations designed to provide intensive conditioning and therapeutic benefits to both the hair shaft and scalp. Unlike conventional conditioners, which act primarily on the surface of the hair, hair masks are formulated to penetrate deeper into the cuticle and cortex layers, delivering essential nutrients and bioactive compounds. This deeper penetration is achieved due to prolonged contact time and the presence of active herbal ingredients that enhance absorption and efficacy.

The primary function of a hair mask is to restore moisture balance and repair damage caused by environmental stressors such as pollution, ultraviolet radiation, and excessive use of chemical-based products. Hair masks help replenish lost lipids and proteins within the hair shaft, thereby improving elasticity, strength, and overall texture. Regular use of hair masks has been shown to reduce hair breakage, minimize split ends, and enhance shine by smoothing the cuticular surface [9].

Multipurpose hair masks, particularly those formulated with herbal ingredients, offer additional advantages by addressing multiple hair concerns simultaneously. These formulations typically combine ingredients with complementary properties, such as moisturizing agents, antimicrobial compounds, and antioxidants. For instance, ingredients like aloe vera provide hydration, neem exhibits antifungal activity that helps control dandruff, and fenugreek supplies proteins that strengthen hair roots. Such synergistic combinations make multipurpose hair masks highly effective in maintaining overall hair and scalp health.

Another important aspect of hair mask use is its role in improving scalp condition. A healthy scalp is essential for proper hair growth, as it ensures adequate blood circulation and nutrient supply to hair follicles. Hair masks help in removing excess oil, dirt, and product buildup from the scalp while maintaining its natural pH. Additionally, herbal masks can soothe irritation, reduce inflammation, and prevent microbial infections, thereby creating a favorable environment for hair growth [10].

The method of application also contributes significantly to the effectiveness of hair masks. Typically, the mask is applied evenly from roots to tips and left on the hair for a specified duration, usually ranging from 15 to 30 minutes. This allows sufficient time for the active ingredients to penetrate the hair shaft and scalp. In some cases, mild heat

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application or covering the hair can enhance absorption by opening the cuticle layers. After the treatment period, the mask is rinsed off thoroughly, leaving the hair soft, manageable, and revitalized.

Furthermore, hair masks play a preventive role by protecting hair from future damage. The formation of a protective layer over the hair shaft helps reduce the impact of environmental stressors and mechanical damage caused by styling practices. Herbal hair masks, in particular, are preferred due to their minimal side effects and compatibility with different hair types. Their regular use contributes to long-term hair health by maintaining hydration, improving texture, and supporting natural hair growth.

In conclusion, hair masks serve as an essential component of modern hair care routines, offering both corrective and preventive benefits. Multipurpose herbal hair masks, with their combination of natural ingredients, provide a holistic approach to hair care by addressing multiple concerns while ensuring safety and effectiveness.

- *Importance of Ingredients Used*

The selection of ingredients in a multipurpose herbal hair mask is critically important from a phytochemical standpoint, as the therapeutic efficacy of the formulation largely depends on the presence of bioactive constituents. Phytochemicals are naturally occurring chemical compounds found in plants that contribute to their medicinal properties. These include alkaloids, flavonoids, tannins, saponins, glycosides, proteins, carbohydrates, and volatile oils, all of which play significant roles in maintaining scalp health and improving hair quality.

Flavonoids and phenolic compounds are well known for their antioxidant properties, which help neutralize free radicals generated due to environmental stress such as pollution and UV radiation. This antioxidant activity protects the hair shaft from oxidative damage, thereby preventing hair weakening and premature ageing. Tannins contribute to strengthening the hair by forming protective complexes with proteins, while also exhibiting mild antimicrobial properties that help in maintaining scalp hygiene.

Alkaloids present in certain herbal ingredients stimulate hair follicles and may promote hair growth by enhancing blood circulation to the scalp. Saponins possess natural cleansing and foaming properties, which aid in the removal of dirt and excess sebum without causing irritation. Proteins and amino acids are essential for repairing damaged hair shafts, improving elasticity, and reducing breakage. Carbohydrates, on the other hand, help in retaining moisture and providing hydration to dry and brittle hair.

Volatile oils, commonly found in herbs such as neem and hibiscus, exhibit antimicrobial and antifungal activities, making them effective against dandruff and scalp infections. The synergistic action of these phytochemicals enhances the overall performance of the hair mask by providing multiple benefits such as nourishment, protection, conditioning, and scalp health improvement.

Therefore, understanding the phytochemical composition of herbal ingredients is essential for designing an effective multipurpose hair mask. Proper selection and combination of these ingredients ensure enhanced therapeutic efficacy, safety, and stability of the formulation.[4,5,11]

II. METHODOLOGY USED FOR HAIR MASK PREPARATION

The preparation of a multipurpose herbal hair mask involves systematic processing of plant materials to ensure the preservation of active phytoconstituents and uniformity of the final formulation. Standard pharmacognostic and cosmetic formulation techniques are followed to obtain a stable and effective product. The methodology includes several sequential steps such as collection, drying, size reduction, powdering, and blending of ingredients.

- *Collection and Authentication of Raw Materials*

The herbal ingredients used in the formulation, such as amla, neem, fenugreek, and hibiscus, are collected from reliable sources and authenticated based on their morphological and botanical characteristics. Proper identification is essential to ensure the quality, purity, and efficacy of the formulation.

- *Cleaning and Washing*

Collected plant materials are thoroughly washed with distilled water to remove dust, dirt, and other contaminants. This step is crucial to prevent microbial contamination and ensure the safety of the final product.

- *Drying*

The cleaned materials are subjected to shade drying at room temperature. Shade drying is preferred over sun drying as it helps in preserving heat-sensitive phytoconstituents such as volatile oils and vitamins. Excessive heat may degrade active compounds, thereby reducing the therapeutic efficacy of the formulation.

- *Size Reduction (Crushing)*

The dried plant materials are coarsely crushed using mortar and pestle or mechanical crushers. This step facilitates uniform grinding and enhances the efficiency of the subsequent powdering process.

- *Grinding*

The crushed materials are finely powdered using a grinder. Fine powder increases the surface area, which improves the extraction and availability of active constituents when the hair mask is applied.

- *Sieving*

The powdered material is passed through a standard sieve (commonly 60 mesh) to obtain uniform particle size. Uniformity in particle size ensures better mixing, smooth texture, and ease of application of the hair mask.

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➢ *Blending of Ingredients*

Accurately weighed quantities of each powdered ingredient are mixed thoroughly using geometric dilution method to ensure uniform distribution of all components. Homogeneous mixing is essential to maintain consistency and effectiveness of the formulation.

➢ *Packaging and Storage*

The prepared hair mask powder is stored in airtight containers to protect it from moisture, light, and microbial contamination. Proper storage conditions help in maintaining the stability and shelf life of the formulation.[12,13,14,15]

This systematic methodology ensures that the final herbal hair mask retains its phytochemical properties, exhibits uniformity, and provides optimal therapeutic benefits when applied.

III. EVALUATION OF MULTIPURPOSE HERBAL HAIR MASK

The evaluation of a multipurpose herbal hair mask is a crucial step in determining its quality, safety, efficacy, and consumer acceptability. Various parameters such as organoleptic, physiological, phytochemical, and performance characteristics are assessed to ensure that the formulation meets standard cosmetic and pharmaceutical requirements. These evaluation criteria collectively provide insight into the stability, functionality, and therapeutic potential of the formulation.

➢ *Organoleptic Evaluation*

Organoleptic evaluation involves the assessment of sensory characteristics such as colour, odour, and appearance. These parameters play a significant role in determining consumer acceptance and overall product quality. The colour of the formulation is influenced by the natural pigments present in herbal ingredients such as chlorophyll, flavonoids, and tannins, which may vary depending on the source and processing conditions [16]. The odour of the hair mask is primarily attributed to volatile oils and aromatic compounds present in ingredients like neem and hibiscus, which also contribute to antimicrobial activity [17].

Appearance, including texture and smoothness, is an important factor that affects ease of application and uniform distribution on the scalp. A fine and homogeneous powder ensures better adherence and improved performance of the formulation. Any deviation in these parameters may indicate instability, contamination, or improper processing [18]. Organoleptic evaluation thus provides a preliminary but essential assessment of product quality and acceptability.

➢ *Physiological Evaluation*

Physiological parameters such as pH, ash content, total ash content, and loss on drying are critical in assessing the compatibility and stability of the hair mask.

The pH of the formulation plays a vital role in maintaining scalp health, as the natural pH of the scalp ranges between 5.5 and 6.5. Formulations with inappropriate pH may disrupt the acid mantle of the scalp, leading to irritation, dryness, or microbial growth [19]. Maintaining an optimal pH ensures that the formulation is gentle and suitable for regular use.

Ash content is used to determine the presence of inorganic impurities such as sand, soil, and metallic salts. High ash values may indicate contamination or adulteration of raw materials [14]. Total ash content provides an estimate of the total mineral content present in the formulation, which can be beneficial in evaluating the nutritional contribution of herbal ingredients.

Loss on drying (LOD) is an important parameter that indicates the moisture content of the formulation. Excess moisture can lead to microbial growth and reduced shelf life, whereas very low moisture may affect the texture and usability of the product [13]. Therefore, maintaining an optimal moisture level is essential for ensuring product stability and effectiveness.

➢ *Phytochemical Evaluation*

Phytochemical evaluation is carried out to identify the presence of bioactive compounds responsible for the therapeutic effects of the hair mask. Herbal ingredients are rich in secondary metabolites such as alkaloids, flavonoids, tannins, saponins, proteins, and carbohydrates, which contribute to hair nourishment and scalp health.

Alkaloids are known for their biological activity and may help stimulate hair follicles and improve blood circulation in the scalp [11]. Carbohydrates play a role in hydration and conditioning of hair by retaining moisture and improving texture [4]. Proteins are essential for strengthening the hair shaft, repairing damaged cuticles, and improving elasticity, thereby reducing hair breakage [5].

Volatile oils present in herbal ingredients exhibit antimicrobial and antifungal properties, which help in controlling dandruff and maintaining scalp hygiene. The presence of these phytoconstituents confirms the therapeutic potential of the formulation and supports its use as a multipurpose hair care product [20].

➢ *Solid Content*

Solid content is an important parameter that determines the amount of active material present in the formulation. It directly influences the consistency, spreadability, and effectiveness of the hair mask. A higher solid content indicates a greater concentration of active ingredients, which enhances the nourishing and conditioning effects of the formulation. However, excessively high solid content may lead to difficulty in application and removal. Therefore, an optimal balance is necessary to ensure both efficacy and usability[17].

➢ *Dispersion of Dirt*

Dispersion of dirt is used to evaluate the cleansing ability of the hair mask. Herbal formulations containing natural saponins and surfactant-like compounds help in loosening dirt and impurities from the scalp and hair.

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Effective dispersion ensures that dirt is removed without excessive stripping of natural oils, thereby maintaining scalp balance[16]. This property is particularly important for multipurpose formulations that aim to combine cleansing and conditioning functions.

- *Spreadability*

Spreadability is a key parameter that determines the ease of application of the hair mask. Good spreadability ensures uniform distribution of the formulation over the scalp and hair, which enhances its effectiveness. It is influenced by factors such as particle size, moisture content, and formulation consistency. A formulation with poor spreadability may lead to uneven application and reduced therapeutic benefits [18]. Therefore, optimizing spreadability is essential for improving user experience and product performance.

- *Washability*

Washability refers to the ease with which the formulation can be removed from the hair after application. A good hair mask should be easily washable without leaving residue or causing heaviness. Poor washability may result in product buildup, which can clog hair follicles and lead to scalp issues. Herbal formulations generally exhibit better washability due to the absence of synthetic polymers and silicones [2]. This parameter is important in ensuring user convenience and product acceptability.

- *Microbial Assay*

Microbial evaluation is essential to ensure the safety and stability of the formulation. Herbal products are more susceptible to microbial contamination due to the presence of natural organic matter and moisture. The microbial assay helps in determining the presence of bacteria, fungi, and other microorganisms that may affect product quality and safety.

A formulation with low microbial load indicates good manufacturing practices and proper storage conditions. The presence of antimicrobial phytochemicals such as flavonoids and essential oils in herbal ingredients can help inhibit microbial growth [14]. Ensuring microbial safety is critical for preventing infections and maintaining product integrity.

- *Stability Studies*

Stability studies are conducted to evaluate the physical, chemical, and microbiological stability of the formulation over time. These studies involve storing the product under different environmental conditions such as temperature, humidity, and light, and observing changes in parameters like colour, odour, texture, and pH.

Stability testing ensures that the formulation retains its efficacy, safety, and quality throughout its shelf life. According to ICH guidelines, stability studies are essential for predicting product behavior under various storage conditions and establishing appropriate storage recommendations [21]. A stable formulation demonstrates consistency in performance and enhances consumer confidence.

IV. OBSERVATIONS

The expected observations of a multipurpose herbal hair mask are based on previously reported studies on herbal cosmetic formulations and standard evaluation parameters. These observations provide an indication of the anticipated performance, stability, and acceptability of the formulation.

- *Organoleptic Observations*

The formulated hair mask is expected to exhibit a natural greenish to brownish colour, depending on the combination of herbal ingredients such as amla, neem, and hibiscus, which contain natural pigments like chlorophyll and polyphenols [22]. The odour is typically characteristic and pleasant, attributed to volatile constituents present in plant materials, contributing to user acceptability [23]. The appearance is expected to be a fine, homogeneous powder with smooth texture, indicating proper grinding and sieving, which ensures uniform application [24].

- *Physiological Observations*

The pH of the formulation is expected to be in the range of 5.5–6.5, which is compatible with the natural pH of the scalp and helps maintain the acid mantle [21]. The ash content and total ash values are expected to remain within acceptable limits, indicating minimal contamination with inorganic impurities [11].

The loss on drying (LOD) is anticipated to be low, suggesting minimal moisture content and reduced chances of microbial growth, thereby enhancing shelf life and stability [25].

- *Phytochemical Observations*

Phytochemical screening is expected to confirm the presence of alkaloids, carbohydrates, proteins, tannins, flavonoids, and volatile oils, depending on the ingredients used in the formulation. These compounds contribute to antioxidant, antimicrobial, and conditioning properties of the hair mask [26]. The presence of such phytoconstituents supports the therapeutic potential of the formulation in improving scalp health and strengthening hair.

- *Solid Content*

The formulation is expected to show adequate solid content, indicating a sufficient amount of active ingredients responsible for nourishment and conditioning. Balanced solid content ensures effective application without making the formulation too thick or difficult to wash [27].

- *Dispersion of Dirt*

The hair mask is expected to demonstrate good dirt dispersion properties, meaning that dirt particles remain in the water phase rather than adhering to the foam or formulation. This indicates effective cleansing ability without excessive removal of natural oils [28].

- *Spreadability*

Good spreadability is expected, allowing the formulation to be applied uniformly over the scalp and hair. Fine particle size and proper blending contribute to smooth

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spreading, which enhances contact between the formulation and hair shaft [24].

- *Washability*

The formulation is expected to exhibit easy washability, allowing it to be removed without leaving residue or causing heaviness. Herbal formulations generally show better washability due to the absence of synthetic polymers and buildup-forming agents [29].

- *Microbial Assay*

The microbial load is expected to be within acceptable limits or negligible, indicating good quality raw materials and hygienic processing conditions. The presence of natural antimicrobial agents in herbs further supports microbial stability [25].

- *Stability Studies*

The formulation is expected to remain stable under different storage conditions, with no significant changes in colour, odour, texture, or pH over time. Stability indicates that the formulation maintains its efficacy and safety throughout its shelf life [21].

V. DISCUSSION

The present review on the formulation and evaluation of a multipurpose herbal hair mask highlights the growing importance of plant-based cosmetic formulations in modern hair care. The increasing incidence of hair-related problems such as dandruff, hair fall, dryness, and scalp irritation has necessitated the development of safer and more effective alternatives to synthetic products. Herbal formulations, particularly hair masks, offer a promising solution due to their rich phytochemical composition and multifunctional properties.

The evaluation parameters discussed in this review demonstrate that a well-formulated herbal hair mask can achieve desirable physicochemical and functional characteristics. Organoleptic properties such as colour, odour, and texture play a crucial role in consumer acceptance, while physiological parameters like pH, ash content, and moisture content ensure compatibility with the scalp and product stability. Maintaining a pH close to that of the scalp is essential to preserve the natural barrier function and prevent irritation, which is a key consideration in cosmetic formulation [30].

Phytochemical evaluation confirms the presence of bioactive compounds such as flavonoids, tannins, alkaloids, and proteins, which contribute to the therapeutic efficacy of the formulation. These compounds exhibit antioxidant, antimicrobial, and conditioning properties that support scalp health and improve hair quality. The synergistic interaction of these phytoconstituents enhances the overall effectiveness of the hair mask, making it capable of addressing multiple hair concerns simultaneously [31].

Performance parameters such as spreadability, washability, and dirt dispersion further indicate the practical usability of the formulation. Good spreadability ensures uniform application, while easy washability improves user convenience and prevents residue buildup. Effective dirt dispersion demonstrates the cleansing ability of the formulation without disrupting the natural oil balance of the scalp. These characteristics are essential for ensuring both functionality and consumer satisfaction [32].

Microbial stability is another critical factor in herbal formulations, as natural ingredients are more susceptible to contamination. The presence of inherent antimicrobial compounds in herbal ingredients can help reduce microbial load, but proper processing and storage conditions are equally important to ensure product safety. Stability studies confirm that the formulation maintains its physical and chemical properties over time, which is necessary for establishing shelf life and ensuring consistent performance [33].

Overall, this review supports the concept that multipurpose herbal hair masks are effective, safe, and sustainable alternatives to conventional hair care products. However, further research is required to standardize formulations, validate their efficacy through clinical studies, and optimize large-scale production. The integration of traditional knowledge with modern scientific approaches can lead to the development of innovative and high-quality herbal cosmetic products [34].

VI. FUTURE CONSIDERATIONS

Although multipurpose herbal hair masks show promising potential in hair care, several aspects require further investigation and development to enhance their scientific validity, commercial applicability, and global acceptance.

One of the major future considerations is the standardization of herbal ingredients and formulations. Variability in plant sources, harvesting conditions, and processing methods can significantly affect the phytochemical composition and efficacy of the final product. Therefore, establishing standardized protocols for raw material selection and processing is essential to ensure batch-to-batch consistency and reproducibility (35).

Another important aspect is the need for clinical validation and efficacy studies. While in vitro and physicochemical evaluations provide valuable information, clinical trials are necessary to confirm the safety and effectiveness of herbal hair masks in human subjects. Such studies can provide evidence-based support for claims related to hair growth promotion, dandruff control, and hair strengthening (36).

The development of advanced extraction and formulation techniques is also an area of future interest. Techniques such as supercritical fluid extraction, nanoformulations, and encapsulation can enhance the stability, bioavailability, and targeted delivery of active phytoconstituents. These approaches can improve the overall

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performance of herbal hair masks and extend their shelf life (37).

Additionally, long-term stability studies under various environmental conditions are required to establish the shelf life and storage requirements of the formulation. Stability testing helps in understanding the degradation patterns of active compounds and ensures that the product remains safe and effective throughout its intended use period (38).

Another key consideration is the evaluation of safety and toxicity profiles. Although herbal products are generally considered safe, certain plant constituents may cause allergic reactions or irritation in sensitive individuals. Therefore, dermatological testing and toxicity studies are necessary to ensure consumer safety and regulatory compliance (39).

The development of user-friendly and ready-to-use formulations is also important for improving consumer acceptance. Converting traditional powder-based hair masks into creams, gels, or pre-mixed formulations can enhance convenience and broaden market appeal.

Furthermore, there is a growing need for sustainable and eco-friendly practices in herbal cosmetic development. This includes the use of biodegradable packaging, environmentally friendly extraction methods, and ethical sourcing of raw materials to reduce environmental impact (40).

Finally, comparative studies with commercially available synthetic products can help establish the superiority or equivalence of herbal formulations in terms of efficacy, safety, and cost-effectiveness. Such studies can support the wider adoption of herbal hair masks in the cosmetic industry.

VII. CONCLUSION

The present review highlights that multipurpose herbal hair masks are effective and safe alternatives to synthetic hair care products. The use of phytochemical-rich natural ingredients provides multiple benefits such as nourishment, conditioning, scalp protection, and hair strengthening. Evaluation parameters confirm that such formulations can achieve desirable physicochemical stability, good performance, and consumer acceptability. Overall, herbal hair masks represent a promising, eco-friendly, and economical approach for maintaining healthy hair and scalp, with strong potential for future research and commercialization.

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