



International Journal of Research in Pharmaceutical and Nano Sciences

Journal homepage: www.ijrpns.com

<https://doi.org/10.36673/IJRPNS.2026.v15.i02.A06>



FORMULATION OF HERBAL HAIR WAX ALONG WITH HEAT PROTECTING ACTION Moim Raja^{*1}, Pratik Kumar¹, Rohit Prajapati¹, Faizan Raza¹, Prince Kumar Singh¹, Vishal Singh¹, Chandramani Chaurasiya¹

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ABSTRACT

Improving patient adherence to treatments for alopecia and scalp disorders can be significantly supported by the appropriate use of hair cosmetic products. Among these, hair wax plays an important role not only in styling but also in offering a degree of protection to the hair shaft. Hair wax is commonly applied to shape and hold hairstyles, while also forming a thin coating over the hair that may reduce environmental damage and moisture loss. When selected and used correctly, it can complement therapeutic regimens by enhancing the cosmetic appearance of hair, thereby improving patient confidence and willingness to continue treatment. For dermatologists, a comprehensive understanding of hair care products is essential in clinical practice. Variations in hair type, texture and ethnic background influence how products interact with the scalp and hair fibers. By recognizing these differences, clinicians can recommend suitable products, guide proper usage and minimize the risk of adverse effects such as scalp irritation, buildup, or follicular blockage. This personalized approach enhances treatment outcomes and ensures better management of hair and scalp conditions. Historically, natural and plant-derived ingredients have been widely incorporated into hair care formulations. These substances are often preferred due to their favorable safety profile and lower likelihood of causing harmful side effects. A growing body of scientific evidence supports the use of botanical extracts for promoting hair growth, strengthening hair fibers and protecting against external stressors. Ingredients such as herbal oils, plant waxes and extracts rich in antioxidants and nutrients contribute to maintaining scalp health and improving hair quality. Choosing the right hair wax is therefore an important aspect of both personal grooming and supportive hair care. An ideal product should provide adequate hold without making the hair excessively stiff or greasy, should be easy to wash out and should contain ingredients that do not irritate the scalp. Attention should also be given to formulation type-whether water-based or oil-based-as this affects texture, durability and ease of removal. By understanding these factors, individuals can select a product that aligns with their styling needs while also supporting overall hair health.

KEYWORDS

Hair Wax, Hair Care Products, Heat Protectant, Alopecia and Botanical Extracts.

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INTRODUCTION

Hair is a specialized appendage of the skin that originates from hair follicles embedded within the dermis. Each hair fiber consists of three main parts: the root, which lies beneath the skin; the shaft, which extends above the surface and the tip, which

is the distal end of the strand¹. Hair formation begins from the epidermal layer during development. Its growth follows a cyclical pattern involving three key stages: the anagen phase, which is the active growth period; the catagen phase, a brief transitional stage marked by cellular regression; and the telogen phase, during which the hair rests before eventually shedding².

Structure of Hair

Hair is a filamentous structure primarily composed of keratin, a durable protein produced by specialized cells³. These cells gradually lose their vitality as they become keratinized, forming the visible hair strand⁴. Hair originates within follicles, which are downward extensions of the epidermis into the deeper layers of the skin. The portion that projects outward from the skin is known as the hair shaft, while the segment embedded within the skin is referred to as the hair root⁵. At the base of the root lies the hair bulb, a rounded structure situated deep in the dermis. Within the bulb is the hair matrix, a region of rapidly dividing cells responsible for producing new hair tissue. Surrounding this area is the dermal papilla, a connective tissue structure rich in blood vessels that supplies essential nutrients and oxygen required for hair growth⁶.

As the outermost layer of dead skin is continuously shed, the actively proliferating basal cells within the hair bulb undergo rapid division. These newly formed cells are gradually pushed upward, where they elongate, lose their nuclei, and become progressively keratinized to form the hair shaft and root⁷. This upward movement and differentiation closely resemble the process occurring in the basal layer of the epidermis, where new cells are generated and migrate toward the surface, ultimately contributing to the formation of the protective outer skin layers.

The structural organization of hair is highly specialized and consists of three distinct layers, each contributing to its overall function and integrity⁸. The innermost layer, known as the medulla, forms the central core and is composed of loosely arranged cells and air spaces. Although it may play a role in insulation, the medulla is not

present in all types of hair, particularly in fine or lightly pigmented strands⁹. Surrounding the medulla is the cortex, which represents the major portion of the hair fiber. The cortex is made up of elongated, tightly packed keratinized cells containing pigment granules that determine hair colour¹⁰. This layer is primarily responsible for the mechanical strength, elasticity and resilience of the hair.

Encasing the cortex is the cuticle, the outermost protective layer formed by overlapping, scale-like cells composed of hard keratin¹¹. These cells are arranged in a manner similar to roof shingles, creating a barrier that shields the inner layers from physical, chemical, and environmental damage. The condition of the cuticle significantly influences the texture, shine, and overall appearance of the hair¹². When intact and smooth, it reflects light effectively, giving hair a healthy and glossy look; when damaged, it can lead to dryness, roughness, and increased susceptibility to breakage¹³.

In cross-sectional analysis of the hair follicle, these layers can be observed in varying proportions depending on factors such as hair type, ethnicity and physiological condition. The presence or absence of the medullary layer, as well as the thickness of the cortex and the integrity of the cuticle, plays a crucial role in determining the physical characteristics and behavior of the hair strand¹⁴.

The Cuticle

The cuticle is the outermost layer of the hair shaft and is composed of approximately eight to ten layers of thin, flattened cells arranged in an overlapping pattern. This arrangement resembles roof shingles and gives the cuticle a smooth, protective surface¹⁵. Due to its thin and compact structure, the cuticle appears nearly transparent, allowing the natural colour of the underlying cortex to be visible, much like light passing through glass¹⁶.

The primary role of the cuticle is to protect the inner layers of the hair, particularly the cortex, from mechanical damage, chemical exposure, and environmental stress such as heat, pollution, and ultraviolet radiation¹⁷. The integrity of this layer is

essential for maintaining hair strength, shine, and overall health¹⁸.

The cells of the cuticle are firmly held together by strong chemical linkages, including disulphide bonds, which provide structural stability and resistance to damage. These bonds help maintain the compact arrangement of the cuticle cells, ensuring that they remain tightly aligned and effective as a protective barrier¹⁹. When the cuticle is intact, it contributes to smooth texture and light reflection; however, when it is disrupted, the hair may become dull, rough, and more prone to breakage²⁰.

The Cortex

The cortex forms the largest portion of the hair shaft, contributing nearly 75% of its total weight²¹. It is located at the core of each hair fiber and is composed of elongated, tightly packed keratin structures. These keratin units are organized in a highly ordered manner and are held together by strong chemical linkages, particularly disulphide bonds, which provide strength, flexibility, and durability to the hair. The cortex also contains pigment granules responsible for hair color and plays a key role in determining the texture, elasticity, and mechanical properties of the hair. From the microscopic arrangement of keratin proteins to the overall structure of the cortex, this layer exhibits a complex hierarchical organization that supports the integrity and resilience of the hair strand²².

Medulla

The medulla is the innermost region of the hair shaft and forms the central core in many, but not all, hair fibers. It is more commonly present in thick, coarse hair and may be absent in finer strands²³. Structurally, the medulla consists of loosely arranged cells and air spaces and although its exact function is not fully defined, it is believed to contribute to insulation and the overall structure of the hair²⁴.

Hair Wax

Hair wax is a semi-solid styling product widely used to shape and hold hair in place. It typically contains natural or synthetic waxes that provide a

flexible hold without causing the hair to stiffen. Unlike hair gels, which often contain alcohol and can lead to dryness and rigidity, hair wax remains pliable, allowing for restyling throughout the day²⁵. It is available under various forms such as pomade, putty, styling paste, or shaping gum, each differing in texture, consistency, and level of hold²⁶.

Historically, wax-based hair products have been used for centuries. Early forms of hair wax can be traced back to ancient civilizations, where waxy, soap-like substances were applied to maintain hairstyles rather than for cleansing purposes²⁷. Traditional pomades, for instance, were used not only to style hair but also to impart a glossy appearance²⁸.

Hair wax offers multiple benefits beyond styling. It helps improve hair texture, enhances shine, and adds definition while maintaining a natural look. Its unique consistency allows hair to remain soft, flexible and manageable rather than stiff or brittle²⁹. Additionally, it can provide mild conditioning effects, reducing dryness and minimizing breakage when used appropriately³⁰.

Herbal Hair Wax with Heat Protection

Herbal hair wax enriched with heat-protective properties represents an advanced form of styling product that combines cosmetic and protective functions³¹. In addition to offering styling control, it forms a protective layer over the hair, reducing damage caused by high-temperature styling tools such as straighteners and curling irons. This helps prevent common issues like dryness, split ends and structural weakening of the hair³².

Such formulations often incorporate natural ingredients known for their nourishing and protective effects. Oils like coconut oil, argan oil and shea butter help moisturize and strengthen the hair, while botanical extracts such as aloe vera, chamomile and green tea provide soothing, antioxidant, and revitalizing benefits for both hair and scalp³³.

By using herbal hair wax with heat protection, individuals can achieve desired hairstyles while maintaining hair health. It allows for effective styling without compromising the structural

integrity of the hair, making it a valuable option for those seeking both aesthetic and protective benefits in a single product³⁴.

Herbal Hair Wax with Heat Defense

Herbal hair wax with heat protection is designed to offer a natural and efficient way to safeguard hair from the harmful effects of thermal styling³⁵. While conventional hair waxes are primarily intended for shaping and holding hairstyles, this advanced formulation extends its function by incorporating ingredients that form a protective barrier against heat. This barrier helps reduce damage caused by styling tools, including dryness, brittleness, and the formation of split ends³⁶.

In addition to protection, the inclusion of plant-based extracts and nourishing oils enhances the overall condition of the hair³⁷. These ingredients contribute to improved hydration, softness, and revitalization, allowing the hair to remain healthy while being styled. As a result, this type of product not only maintains hairstyle integrity but also supports long-term hair care³⁸.

Herbal hair wax represents an innovative development in cosmetic science by combining styling efficiency with therapeutic benefits. Unlike conventional products that may rely heavily on synthetic compounds, herbal formulations utilize naturally derived components such as botanical extracts and plant oils³⁹. These ingredients are known for their gentle action and reduced risk of adverse effects, making them suitable for regular use.

A key advantage of herbal hair wax lies in its multifunctional nature. It not only provides hold and definition to hairstyles but also delivers conditioning, protection and in some cases, support for healthier hair growth⁴⁰. This dual action makes it a comprehensive solution for individuals seeking both aesthetic and restorative benefits. By choosing such formulations, users can achieve their desired appearance while maintaining the strength and vitality of their hair⁴¹.

Although many commercial hair wax products are available, the development of herbal hair wax with heat protection focuses on the use of natural

materials such as coconut oil and other plant-based ingredients. This approach emphasizes safety, effectiveness and sustainability in cosmetic formulation⁴².

Ingredients

Beeswax (Cera alba)

Beeswax has long been recognized as a key ingredient in hair care and cosmetic preparations. It is a natural wax produced by honeybees and has been utilized for centuries due to its beneficial properties. In hair formulations, beeswax acts as a structuring agent that provides hold and stability to hairstyles⁴³. It forms a light coating over the hair strands, helping to retain moisture and protect against environmental damage⁴⁴.

In addition to its styling properties, beeswax is valued for its conditioning effects. It helps smooth the hair surface, reduces frizz and enhances shine without causing excessive dryness. Its natural origin and compatibility with other herbal ingredients make it a preferred component in modern cosmetic formulations⁴⁵.

With increasing interest in natural and sustainable products, beeswax continues to gain attention in the beauty and healthcare industries. Ongoing scientific studies support its role in improving hair manageability and protection, reinforcing its importance as a versatile and effective ingredient in herbal hair wax preparations⁴⁶.

Because the formulation also included other active ingredients such as *Cannabis sativa*, it is difficult to attribute hair growth effects solely to beeswax. Although beeswax may contribute to improved hair condition and possibly support growth, the observed results are more likely due to the combined action of multiple natural components working together⁴⁷.

Biological Source

Beeswax is a naturally occurring substance produced within the hives of the honeybee, *Apis mellifera*⁴⁸.

Family: Apidae

Uses and Benefits in Hair Wax Formulation

Beeswax serves as a key structural component in herbal hair wax, providing firmness, texture, and hold to the final product⁴⁹. It acts as a base that

helps maintain the consistency of the formulation while also forming a protective layer over the hair shaft. This coating helps retain moisture and offers some protection against heat and environmental stress⁵⁰.

In addition to its cosmetic role, beeswax possesses beneficial biological properties⁵¹. It exhibits mild antibacterial and anti-inflammatory effects, which can aid in soothing minor scalp irritation and supporting overall scalp health⁵². The presence of vitamin A in beeswax contributes to cell regeneration, helping maintain healthy skin and hair follicles. These combined properties may indirectly promote healthier hair growth by improving scalp condition⁵³.

Unlike synthetic ingredients that may contain harsh chemicals, beeswax is a natural and non-toxic substance, making it suitable for regular use. It helps reduce frizz, adds a subtle shine, and can assist in sealing split ends, especially in dry or damaged hair. Beeswax-based products are particularly effective for thicker or textured hair types, as their natural weight helps maintain shape and definition⁵³. They are also commonly used in styling techniques such as dreadlocks due to their ability to provide long-lasting hold and reduce breakage⁵⁴.

Dermatological Relevance

Beeswax may also play a supportive role in managing certain scalp conditions such as dandruff and irritation. Studies have suggested that formulations containing beeswax, especially when combined with other natural substances like honey, can improve symptoms associated with conditions such as eczema, psoriasis and seborrheic dermatitis by reducing dryness and inflammation⁵⁵.

Method of Application

For best results, beeswax should be applied in small amounts to slightly damp or dry hair. A small quantity should be warmed by rubbing it between the palms until it softens, making it easier to distribute evenly⁵⁶. It should then be gently worked through the hair, focusing primarily on the mid-lengths and ends to enhance hold and manageability. Direct application to the scalp

should be avoided, as excessive buildup may clog pores. Continuous application should be minimal and controlled to prevent heaviness or residue accumulation⁵⁷.

Extraction of Beeswax

Beeswax can be obtained from honeycombs using several simple and effective methods, all of which rely on heat to separate wax from impurities⁵⁸.

One common technique involves melting the wax in hot water using a filter bag. Crushed combs are placed inside a cloth or filter bag and immersed in heated water. As the wax melts, it passes through the fabric and floats on the water's surface. Upon cooling, the wax solidifies and can be easily collected⁵⁹.

Another method is solar extraction, which utilizes sunlight as a natural heat source. In this approach, crushed combs are placed inside a solar wax extractor, typically enclosed with a glass cover⁶⁰. Sunlight heats the wax, causing it to melt and flow through a filter into a collection container. After removal, the wax cools and solidifies. This method is cost-effective and environmentally friendly, although care must be taken in hot climates to prevent overheating or burning of the wax⁶¹.

A third technique involves steam or distillation. In this process, the combs are suspended in a filter bag above boiling water⁶². Steam heat melts the wax, which then drips through the filter into a container below. Continuous heating is required and water levels must be maintained during the process⁶³.

Hot Water Extraction Method

In this method, honeycombs are first cleaned to remove residual honey and debris. The combs are then placed in a heat-resistant bag and submerged in a container of hot water. The water should be heated gently rather than brought to a vigorous boil, as excessive heat may mix impurities with the wax and affect its quality⁶⁴. The bag is pressed repeatedly to ensure complete melting and release of wax. Once the process is complete, the container is left undisturbed to cool. The wax rises to the surface and solidifies, forming a layer that can be removed easily⁶⁵.

Solar Wax Extraction

For solar extraction, cleaned combs are placed inside a solar extractor lined with a light filtering material such as cloth or nylon⁶⁶. The unit is positioned to receive maximum sunlight. As the wax melts, it passes through the filter and collects in a container. After sufficient melting, the wax is removed and allowed to cool and harden⁶⁷.

Distillation Method

In this approach, cleaned combs are tied in a suitable fabric bag and suspended inside a vessel. A container is placed below the bag, while water is heated underneath. As steam forms, it melts the wax, which then drips into the container⁶⁸. It is important to monitor water levels and replenish them as needed to maintain continuous steam production⁶⁹.

Coconut Oil

Dandruff is a common, recurring scalp condition affecting a large portion of the global population. Scientific studies, including metagenomic analyses of the scalp microbiome, have highlighted the importance of beneficial microorganisms in maintaining scalp health⁷⁰. These microbes contribute to the production of essential nutrients such as vitamins and amino acids⁷¹.

Coconut oil has been traditionally used in many regions, particularly in tropical countries, as a natural remedy for maintaining scalp and hair health. It possesses moisturizing, antimicrobial, and nourishing properties that help improve scalp condition. Regular application of coconut oil can support the balance of the scalp microbiome, reduce dryness and alleviate flaking associated with dandruff⁷².

Furthermore, coconut oil penetrates the hair shaft effectively, reducing protein loss and strengthening hair from within. Its use in hair care formulations, including herbal hair wax, enhances conditioning, improves texture and supports overall hair health. Ongoing research continues to explore its influence on both bacterial and fungal populations of the scalp, reinforcing its importance as a multifunctional natural ingredient⁷³.

A longitudinal study spanning 16 weeks was carried out on 140 Indian women, divided equally between individuals with dandruff and those without. The intervention phase lasted 12 weeks, followed by a 4-week observation period to assess relapse⁷⁴. Approximately 900 scalp samples were analyzed during the course of the study. The findings indicated that, after treatment, improvements in dandruff-related parameters were associated with shifts in the scalp microbiota. Notably, there was a reduction in fungal pathogenic activity alongside an increase in beneficial microbial functions, including pathways involved in biotin metabolism⁷⁵. These results highlight the role of coconut oil in modulating the scalp microbiome and maintaining overall scalp health⁷⁶.

Biological Source

Cocos nucifera (L.), belonging to the family Arecaceae, is commonly referred to as the coconut tree⁷⁷.

Uses and Benefits in Hair Care

Coconut oil is widely used in hair care for its ability to reduce dandruff, restore shine to dull and damaged hair, control frizz, and provide protection against styling-related damage. It is generally suitable for most hair types and is a valuable ingredient in herbal hair wax formulations, particularly those designed with heat-protective properties⁷⁸.

Its strong moisturizing and nourishing capabilities help maintain hydration within the hair shaft, improving softness and manageability. Coconut oil also enhances shine and smoothness, making hair appear healthier and more vibrant. Due to its penetration ability, it reduces protein loss from hair strands, thereby strengthening them and minimizing breakage⁷⁹.

In addition, coconut oil forms a thin protective layer over the hair surface, which helps shield it from thermal damage caused by styling tools. Its natural composition also imparts a mild, pleasant fragrance to hair care products⁸⁰.

Additional Functional Benefits

Prevention of Split Ends

Coconut oil helps repair and prevent split ends by reducing dryness and brittleness at the hair tips⁸¹.

Improved Shine and Texture

Rich in lauric acid and essential fatty acids, it imparts a smooth, glossy appearance to the hair while improving texture⁸².

Anti-Dandruff Activity

Coconut oil supports scalp health by moisturizing the skin, reducing flaking, and helping to control dandruff. Scientific studies suggest it possesses antibacterial, anti-inflammatory and antioxidant properties, which contribute to restoring the scalp barrier and balancing microbial populations⁸³.

Cuticle Protection

By hydrating and strengthening the outer cuticle layer, coconut oil enhances resistance to environmental stressors such as pollution and heat, thereby maintaining hair integrity and reducing damage⁸⁴.

Overall, coconut oil serves as a multifunctional ingredient in herbal hair wax, offering both cosmetic and therapeutic benefits. Its incorporation into formulations with heat protection makes it especially valuable for maintaining healthy, strong and well-conditioned hair while enabling effective styling⁸⁵.

Anti-Frizz and Protective Effects of Coconut Oil

Coconut oil is widely recognized for its ability to control frizz and improve hair manageability. Its cuticle-smoothing action helps reduce roughness on the hair surface, thereby minimizing frizz, especially in humid conditions. When used as a serum or hair mask, it forms a light coating over the hair shaft that prevents excess moisture absorption from the environment, which is a major cause of frizz⁸⁶.

In addition, coconut oil is rich in vitamin E, which plays an important role in protecting hair from oxidative stress caused by free radicals⁸⁷. This protective effect helps shield hair from environmental aggressors such as pollution and ultraviolet (UV) radiation. Regular application, including overnight treatments, allows deeper

penetration into the hair shaft, leading to improved hydration, strength, and overall hair health⁸⁸.

Coconut oil may also support hair growth by nourishing the scalp and strengthening hair follicles. This can result in reduced hair fall and the appearance of thicker, fuller hair. Furthermore, its antioxidant properties may contribute to delaying premature greying by protecting hair from cellular damage⁸⁹.

Applications of Coconut Oil for Hair Care

Coconut oil can be used as a daily hair treatment, overnight therapy, or deep conditioning agent⁹⁰.

For routine care, a small amount can be gently massaged into the scalp and distributed through the hair lengths.

It can be combined with essential oils to enhance its therapeutic benefits.

As a deep conditioner, it should be applied to the scalp and hair and left for at least 30 minutes before washing⁹¹.

For intensive nourishment, it can be applied before bedtime and left overnight, followed by regular washing and conditioning in the morning.

Jasmine Oil

Jasmine oil is a valuable essential oil derived from the fragrant white flowers of *Jasminum officinale*. It is known for its soothing, conditioning, and aromatic properties, making it a beneficial ingredient in hair and scalp care formulations⁹². The jasmine plant is believed to have originated in regions such as Iran and thrives in tropical climates. Due to the complexity of extraction and limited yield, pure jasmine oil is relatively expensive and is therefore used sparingly in many cosmetic products⁹³.

In most formulations, jasmine is incorporated in the form of essential oil blends rather than as a pure extract. It is commonly added to shampoos, conditioners, scalp treatments and styling products to enhance both fragrance and therapeutic value. In addition to its cosmetic applications, jasmine oil is also used in aromatherapy, where it is associated with mood enhancement and relaxation⁹⁴.

Biological Source

Jasmine oil is obtained from the flowers of *Jasminum officinale*.

Uses and Benefits in Hair Care

Jasmine oil is valued for its pleasant fragrance as well as its beneficial effects on the scalp and hair. It acts as an emollient, helping to moisturize and soften the hair while improving texture and manageability. Its soothing properties can help reduce scalp irritation and inflammation, making it suitable for sensitive or dry scalp conditions⁹⁵.

Additionally, jasmine oil exhibits antimicrobial activity, which supports a healthy scalp environment by helping to control microbial imbalance. When included in herbal hair wax formulations, it contributes not only to hair conditioning and scalp care but also enhances the overall sensory experience of the product⁹⁶.

Jasmine oil adds both therapeutic and sensory value to hair care formulations. Its naturally calming aroma creates a relaxing experience during use, making hair care routines more pleasant while leaving the hair lightly fragranced and refreshed⁹⁷.

From a functional perspective, jasmine oil helps improve the overall condition of the hair by providing hydration and enhancing elasticity. By nourishing both the hair shaft and roots, it reduces brittleness and minimizes breakage. This results in smoother, softer strands with a healthier, fuller appearance and natural shine. Its ability to penetrate the hair structure allows it to improve flexibility, making hair easier to manage, detangle and style—particularly beneficial for dry, frizzy, or unmanageable hair⁹⁸.

Jasmine oil also exhibits antimicrobial and antiviral properties, which support scalp health. It can help manage common scalp concerns such as irritation, redness, dandruff, and conditions like dermatitis. These properties contribute to maintaining a balanced scalp environment, which is essential for healthy hair growth⁹⁹.

In addition, jasmine oil supports cellular renewal due to its mild anti-infective nature. It helps soothe dry scalp conditions and assists in sealing the hair cuticle, thereby reducing moisture loss and

preventing split ends. By maintaining hydration in both the scalp and hair fibers, it promotes stronger, more resilient strands¹⁰⁰.

Regular use of jasmine oil can enhance moisture retention, giving hair a silky texture and improving its overall appearance. It also strengthens the tensile properties of hair, which may contribute to increased length and reduced hair fall over time. Furthermore, its cleansing and antimicrobial action can help reduce buildup on the scalp and may assist in controlling scalp infections and even lice infestations¹⁰¹.

Method of Application

Jasmine oil can be applied directly to the scalp and hair as a pre-shampoo treatment. A small quantity should be gently massaged into the scalp and distributed along the hair length. It can be left on for some time before washing, allowing the oil to nourish the scalp, strengthen the hair, and help address factors associated with hair damage and hair loss¹⁰².

Shea Butter (*Butyrospermum parkii* / *Vitellaria paradoxa*)

Shea butter is a natural fat obtained primarily from the nuts of the shea tree, widely cultivated in regions of West Africa such as Ghana. In its unrefined form, it appears ivory in color and has a characteristic nutty aroma, while the refined form is processed to reduce scent and improve acceptability in cosmetic formulations¹⁰³.

Chemically, shea butter is rich in a variety of essential fatty acids, including oleic acid, stearic acid, palmitic acid, linoleic acid, behenic acid and alpha-linolenic acid. It also contains a high proportion of unsaponifiable components, which contribute to its exceptional moisturizing and skin-conditioning properties¹⁰⁴. Due to this unique composition, shea butter acts as a powerful emollient, making it especially beneficial for dry, damaged, and brittle hair.

In hair care applications, shea butter enhances softness and elasticity while helping to restore moisture balance. It is particularly effective for managing frizzy, coarse, or chemically treated hair, as it nourishes the hair shaft and improves overall

texture. By forming a protective barrier, it helps reduce moisture loss, minimize split ends, and improve shine, giving hair a healthier and more manageable appearance. It has traditionally been used in the care of textured and Afro-type hair due to its deep conditioning and strengthening effects¹⁰⁵.

Biological Source

Shea butter is obtained from the seeds of *Vitellaria paradoxa* (formerly *Butyrospermum parkii*), a deciduous tree native to Africa that produces oil-rich fruits after several years of growth¹⁰⁶.

Uses and Benefits in Hair Care

Provides intense hydration and improves moisture retention in hair.

Helps control frizz and enhances smoothness.

Reduces scalp dryness and itching.

Strengthens hair strands and improves elasticity.

Protects hair and scalp from environmental damage, including UV exposure

Restores shine and improves the overall appearance of damaged hair¹⁰⁷.

Due to these properties, shea butter is a valuable ingredient in herbal hair wax formulations, contributing both to styling performance and long-term hair nourishment¹⁰⁸.

Manufacturing Method of Herbal Hair Wax

Phase I (Melting of Base Components)

All primary ingredients such as beeswax and, if included, shea butter are placed in a clean, wide-mouthed beaker. This should be the largest container to allow sufficient space for mixing or whipping later. The beaker is then placed in a water bath maintained at approximately 85-90°C. This temperature range ensures complete melting of beeswax, which has the highest melting point among the ingredients. Gentle heating is important to avoid degradation of the components¹¹⁰.

Phase II (Preparation of Oil Phase)

In separate containers, coconut oil and jasmine oil are mildly heated. This step ensures that all ingredients are at a compatible temperature before mixing, preventing sudden solidification during the combination stage¹¹¹.

Combination of Phases

Once the first phase has completely melted, the beaker is removed from the water bath. Since beeswax tends to solidify quickly, continuous stirring is essential at this stage. When the temperature of the melted mixture drops to around 50-52°C, the pre-heated oils from the second phase are gradually added. Slow addition with constant stirring helps achieve a uniform blend and prevents premature hardening¹¹².

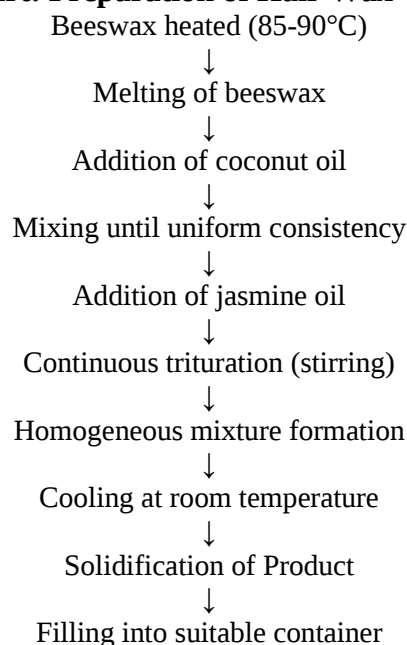
Mixing and Controlled Cooling

The mixture is stirred continuously while it cools. This gradual cooling process is preferred over rapid or “shock” cooling, as it ensures uniform solidification and prevents grainy texture formation. Continuous agitation during cooling helps maintain consistency and smoothness in the final product¹¹³.

Final Processing and Packaging

At this stage, the product can be customized based on the desired texture. For a firm hair wax, the mixture is poured directly into containers and allowed to solidify. For a lighter, whipped texture, the semi-cooled mixture can be aerated using an electric whisk before packaging. While the texture and appearance may vary-ranging from dense to fluffy-the functional effectiveness of the product remains unchanged¹¹⁴.

Flow Chart: Preparation of Hair Wax



Evaluation

Physical Characteristics

The formulated hair wax was evaluated for key physical properties such as phase separation, color, odor, and rheological behavior. These parameters are important as they influence both product stability and consumer acceptance. The prepared formulation appeared white in color with a pleasant fragrance. It exhibited a smooth texture without any visible impurities or foreign particles. No signs of phase separation were observed, indicating good formulation stability¹¹⁵.

Homogeneity

After solidification in the container, the formulation was visually examined to assess its uniformity. Parameters such as consistency, presence of aggregates and any signs of flocculation were carefully checked. The hair wax was found to be uniform, smooth and free from lumps or agglomerates, confirming proper mixing and consistency throughout the formulation¹¹⁶.

pH Determination

The pH of the formulation was measured using a digital pH meter to ensure compatibility with scalp and hair. For analysis, 1 gram of the wax was dispersed in 100mL of distilled water, and the pH was recorded three times to obtain an average value. Maintaining an appropriate pH is essential, as it directly affects scalp health, product performance, and user safety. The formulation demonstrated a suitable pH range, indicating it is safe for topical application and unlikely to cause irritation¹¹⁷.

Ability to Wash

The ease of removal of the prepared hair wax was evaluated by applying it to the skin and washing with water. The formulation was found to be easily washable, leaving no visible residue after rinsing. This indicates good user convenience and suitability for regular use without product buildup¹¹⁸.

Extrudability

The prepared wax was filled into collapsible tubes to assess its extrudability. The formulation was observed to be easily extruded with uniform force, indicating appropriate consistency and suitability

for packaging in tubes without difficulty during application¹¹⁹.

Spread-ability

Spread-ability was determined by placing 2g of the formulation between two glass slides and applying a weight of 500g for a fixed duration of 5 minutes. After removing the weight, the diameter of the spread circle was measured at different points¹²⁰. Spread-ability was calculated using the formula:

$$S = (M \times L) / T$$

The formulation showed a spread-ability value of 13.33cm/sec, indicating good ease of application. Adequate spread-ability ensures uniform distribution of the product and enhances user acceptance.

Skin Irritation Test

The formulation was applied to the skin and observed for any signs of irritation such as redness, itching, or rashes. The treated area was also exposed to sunlight for 4-5 minutes to assess sensitivity. No irritation or adverse reaction was observed, confirming that the formulation is safe and compatible with the skin¹²¹.

Stability Study

Stability refers to the ability of a formulation to retain its physical, chemical and functional properties over time under different environmental conditions. The prepared herbal hair wax was stored at room temperature (25–30°C) for a period of 30 days¹²². During this time, it was periodically evaluated for changes in appearance, consistency, odor, and other parameters. No significant changes were observed, indicating that the formulation is stable under normal storage conditions and maintains its quality over time¹²³.

Table No.1: Formulation of Herbal Hair Wax (100 g batch)¹⁰⁹

S.No	Ingredient	Quantity	Role / Uses in Formulation
1	Beeswax (Cera alba)	2ml	Acts as base and structuring agent; provides hold, texture and stability to the wax
2	Coconut Oil (Cocos nucifera)	50ml	Moisturizer and conditioner; reduces frizz, strengthens hair and provides heat protection
3	Shea Butter (Vitellaria paradoxa)	25ml	Emollient; improves softness, nourishes dry hair, enhances shine and repairs damage
4	Jasmine Oil (Jasminum officinale)	5mg	Fragrance agent; provides antimicrobial, soothing and scalp-conditioning effects

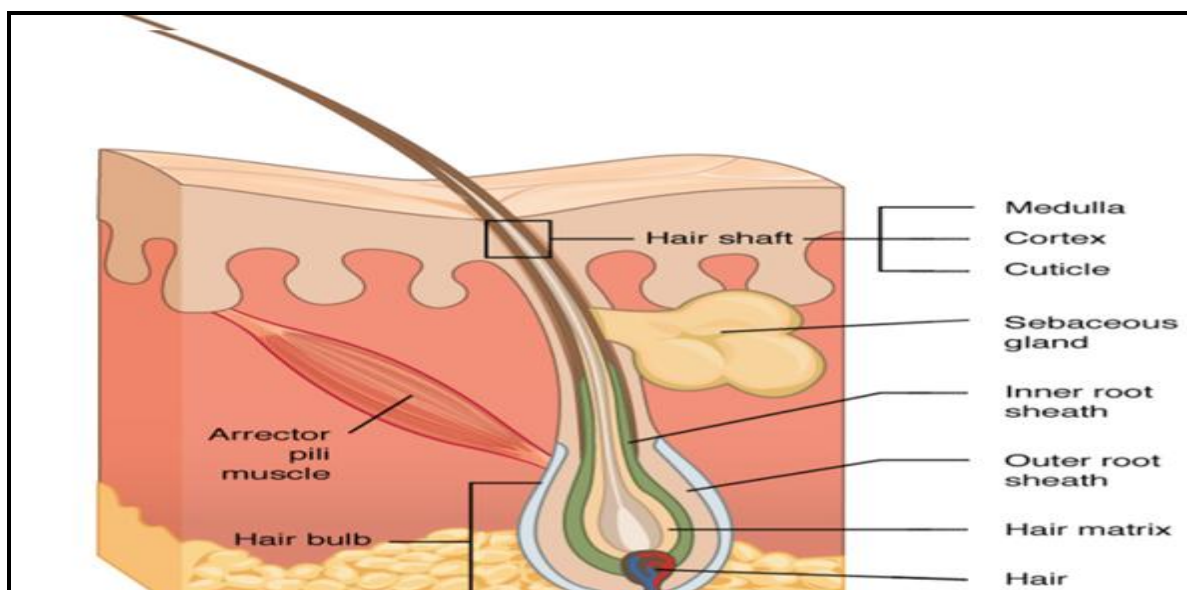


Figure No.1: Structure of Hair

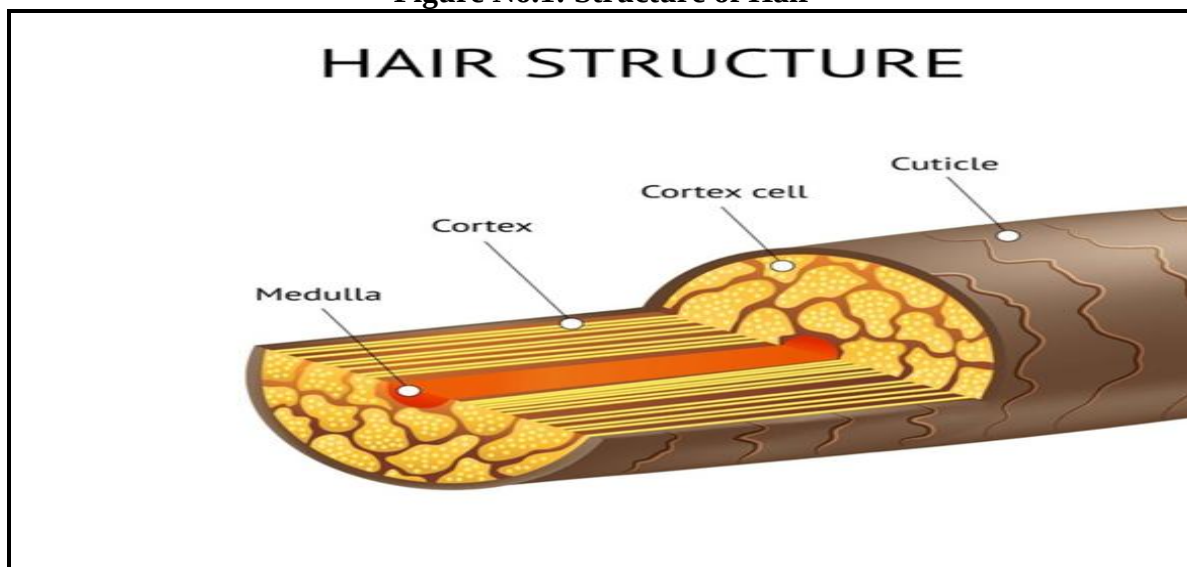


Figure No.2: Layers of Hair

CONCLUSION

Results of this study showed that the hair wax formulation containing propolis and *E. sativa* oil was pharmaceutically stable and well compatible with skin without causing sensitivity reaction. It significantly improved hair growth in animal model and may have promoting effect on hair growth in humans.

ACKNOWLEDGMENT

The authors wish to express their sincere gratitude to Suyash Institute of Pharmacy, Hakkabad, Gorakhpur, Uttar Pradesh, India for providing necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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