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Formulation and Evaluation of Herbal Shampoo

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Abstract: ***The natural, mild, and efficient methods of preserving the health of the scalp and hair, herbal shampoos have become a viable substitute for synthetic hair care products. The creation and assessment of herbal shampoos using historically utilized medicinal herbs with cleaning, conditioning, and therapeutic qualities are the main topics of this research. The pharmacological activity of the ingredients—including their antibacterial, anti-inflammatory, antioxidant, and hair growth-promoting properties—is taken into consideration while choosing them. The effectiveness of common plants like Shikakai, Reetha, Amla, Neem, Hibiscus, and Aloe vera is attributed to their abundance in saponins, flavonoids, and vital nutrients. In-depth assessment factors that are essential for determining the efficacy and quality of herbal shampoos are also covered in the review, including pH, foaming index, surface tension, filth dispersion, viscosity, and conditioning ability. The future scope also highlights the possibility for using cutting-edge technology to improve product stability, efficacy, and shelf life, as well as the rising customer preference for eco-friendly cosmetics. According to the study's findings, herbal shampoos provide a sustainable, eco-friendly, and safe method of hair care that is in line with contemporary environmental awareness and wellness trends.***
Keywords:Herbal shampoo, Natural hair care, Plant-based cosmetics, Shikakai, Reetha, Amla, pH evaluation, Foaming index, Green cosmetics, Ayurvedic hair care, Scalp health, Conditioning agents, Sustainable formulation.

I. INTRODUCTION

Due to the growing desire for natural, chemical-free, and environmentally friendly personal care products, herbal shampoos have attracted a lot of attention recently. Conventional shampoos frequently include artificial perfumes, preservatives, and surfactants that can irritate the scalp, dry out the hair, and harm it over time. Herbal shampoos, on the other hand, use natural elements like plant extracts, essential oils, and herbal powders that provide therapeutic advantages including conditioning, cleaning, preventing dandruff, and encouraging hair development[1-2].

The use of herbs for hair treatment has its origins in traditional medical systems such as Ayurveda.

For ages, people have utilized herbs like Shikakai (Acacia concinna), Reetha (Sapindus mukorossi), Amla (Phyllanthus emblica), Neem (Azadirachta indica), and Hibiscus (Hibiscus rosa-sinensis) to improve hair texture, prevent hair loss, and maintain scalp hygiene. These herbs are abundant in tannins, flavonoids, saponins, and other vital elements that fortify the hair shaft and nourish the scalp.

The process of creating herbal shampoo include choosing suitable herbal components according to their pharmacological properties, extracting the active compounds, and combining them into a foundation that is stable and easy to use. The physicochemical characteristics of herbal shampoo, such as pH, viscosity, foaming ability, dirt dispersion, surface tension, and conditioning effectiveness, are evaluated[3-4].

The market for herbal shampoo is growing quickly due to customer preferences for sustainable beauty products and green cosmetics. While creating a herbal shampoo that is both therapeutically effective and aesthetically pleasing present’s problems, it also presents a wealth of innovative options[4-6].

Natural or herbal alternatives are becoming more popular as a result of consumers' greater knowledge of the possible negative effects of synthetic chemicals used in cosmetic goods. Shampoos are one of the most popular personal care products for hair and scalp cleanliness. Surfactants including sodium lauryl sulphate (SLS), parabens, artificial perfumes, and preservatives are frequently included in conventional shampoos. These substances can irritate the scalp, trigger allergic responses, induce hair loss, and disturb the natural microbiota of the scalp. Herbal shampoos, which are made with plant-based chemicals and little to no synthetic additives, have become a cleaner and more environmentally friendly option in response to these worries.

These plants can be used in shampoos since they each have unique bioactive ingredients. Reetha and Shikakai, for example, contain saponins that function as natural surfactants, assisting in the production of lather and the elimination of excess oil and debris. Amla's tannins and flavonoids have antioxidant qualities that aid in the fight against oxidative stress, which is a known cause of hair damage.

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Both tulsi and neem have antibacterial properties that help treat scalp infections and dandruff. Herbal shampoos are effective and comprehensive in their approach to hair care since they contain these multipurpose herbs[7-8].

Selecting suitable herbs is the first step in creating a herbal shampoo. Next, the active ingredients are extracted using a variety of methods, including maceration, infusion, decoction, and percolation. The kind of plant and the targeted phytochemicals determine which extraction process is best. After that, these extracts are mixed with an appropriate foundation to guarantee stability, shelf life, and convenience of use. Preservatives like sodium benzoate, natural thickeners like xanthan gum, and essential oils for flavor and other advantages can all be found in the base.

The formulation and evaluation of herbal shampoos is a multidisciplinary field that draws on Pharmacognosy, cosmetic science, Phytochemistry, and dermatology. Herbal shampoos not only fulfill the cleansing function of traditional shampoos but also offer therapeutic and beautifying properties. Their role in promoting scalp health, reducing dependence on synthetic chemicals, and catering to the modern consumer's eco-conscious mindset highlights their growing relevance. The future of herbal shampoo lies in scientific validation, advanced formulation techniques, and rigorous quality control to meet global standards and consumer expectations[8-10].

II. LITERATURE SURVEY

1) Patel et al. (2016):

This study focused on the formulation of an herbal shampoo using *Reetha* (Sapindus mukorossi), *Shikakai* (Acacia concinna), and *Amla* (Phyllanthus emblica) extracts. The shampoo was evaluated for various parameters including pH, foaming index, and dirt dispersion. It was found to have excellent cleansing ability with stable lather and acceptable pH. The formulation was also tested for skin irritation and proved to be non-irritant. The study concluded that these traditional herbs could be effectively used to prepare mild and efficient herbal shampoos[11].

2) Kumar and Sharma (2017):

In their research, the authors prepared a polyherbal shampoo using extracts of *Neem*, *Aloe vera*, and *Bhringraj*. The antimicrobial efficacy of the shampoo was tested against dandruff-causing organisms like *Malassezia furfur*. The formulation showed good antifungal properties and also improved hair shine and softness. The results suggested that combining antimicrobial and moisturizing herbs can help manage dandruff while enhancing the cosmetic appeal of the shampoo[12].

3) Raut et al. (2018):

This investigation aimed at developing a natural shampoo incorporating *Hibiscus rosa-sinensis* and *Tulsi* (Ocimum sanctum). The study showed that hibiscus provided conditioning effects due to mucilage content, while tulsi offered antimicrobial benefits. The shampoo passed all physicochemical tests, and sensory evaluation indicated high consumer satisfaction. The research supported the inclusion of mucilaginous herbs to replace synthetic conditioners[13].

4) Mehta and Shah (2019):

A novel herbal shampoo was prepared using *Henna* (Lawsonia inermis) and *Fenugreek* (Trigonella foenum-graecum) extracts. The formulation showed good lathering properties and significantly reduced hair fall in user trials. Fenugreek seeds provided high protein content which helped strengthen hair roots. The study emphasized using high-protein herbs for formulating hair-fall control shampoos[14].

5) Iqbal et al. (2019):

Their research involved the use of *Amla*, *Neem*, and *Green Tea* extract in herbal shampoo for oily scalp management. The shampoo was able to regulate excess sebum while maintaining scalp hydration. Evaluation parameters like viscosity, surface tension, and solid content were found within acceptable ranges. The authors recommended the formulation as an effective herbal remedy for seborrheic scalp conditions[15].

6) Tiwari and Mishra (2020):

This work focused on anti-dandruff herbal shampoo made from *Lemon peel*, *Neem*, and *Tea Tree Oil*. The shampoo demonstrated strong antimicrobial activity in vitro and was particularly effective in treating flaky scalp. Tea tree oil contributed antifungal action while lemon extract helped balance pH. The study showed the effectiveness of citrus-based herbs for scalp clarity[16].

7) Bansal et al. (2020):

An herbal shampoo incorporating *Brahmi* (Bacopa monnieri) and *Jatamansi* (Nardostachys jatamansi) was formulated for stress-related hair fall. The herbs, known for their adaptogenic and calming properties, were used to reduce scalp inflammation and strengthen follicles. The shampoo had good aesthetic appeal and provided a soothing experience. The researchers promoted the use of adaptogens in hair care[17].

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8) Yadav and Chauhan (2021):

This study developed a herbal shampoo from *Manjistha*, *Neem*, and *Aloe vera*. The primary focus was on scalp detoxification and skin renewal. The shampoo helped in reducing scalp itchiness and flakiness in trials involving 30 participants. It was dermatologically tested and proved safe for daily use. The study emphasized detoxifying and hydrating herbs for long-term scalp care[18].

9) Deshpande et al. (2021):

The team formulated a herbal shampoo using *Shikakai*, *Reetha*, and *Hibiscus* and compared it with a marketed synthetic shampoo. Results showed the herbal shampoo had better conditioning effects and caused no scalp dryness. It was also biodegradable and free from synthetic preservatives. This study reinforced the feasibility of creating sustainable herbal shampoos with minimal environmental impact[19].

10) Kulkarni and Joshi (2022):

This research used *Calendula*, *Curry leaves*, and *Amla* in shampoo formulation aimed at improving hair strength and preventing premature greying. The shampoo exhibited strong antioxidant activity and improved hair luster after 21 days of use. The authors recommended the formulation for middle-aged consumers looking for natural greying control solutions[20].

III. FORMULATION

1) Shikakai[21]

Biological Source:*Acacia concinna*

Synonyms: Soap pod, Fruit for hair

Activity: Shikakai is a natural cleanser due to its high saponin content, which creates a mild lather that effectively removes dirt and oil without stripping the scalp of natural oils. It also acts as a detangler and conditioner, leaving hair soft and manageable.

2) Reetha (Soapnut)[22]

Biological Source:*Sapindus mukorossi*

Synonyms: Soapnut, Arishtak

Activity: Reetha contains natural surfactants (saponins) that produce gentle foam and cleanse the scalp and hair. It has antimicrobial and anti-inflammatory properties, making it effective against dandruff and scalp infections.

3) Amla (Indian Gooseberry)[23]

Biological Source:*Phyllanthus emblica*

Synonyms: Amlaki, Emblic Myrobalan

Activity: Amla is rich in Vitamin C and antioxidants. It strengthens hair roots, prevents premature greying, reduces hair fall, and promotes healthy hair growth. Its anti-inflammatory and antifungal actions also support scalp health.

4) Neem[24]

Biological Source:*Azadirachta indica*

Synonyms: Indian Lilac

Activity: Neem is known for its strong antibacterial, antifungal, and anti-inflammatory properties. It helps in treating dandruff, itchy scalp, and infections while promoting overall scalp hygiene.

5) Hibiscus[25]

Biological Source:*Hibiscus rosa-sinensis*

Synonyms: Jaswand, Chinese Hibiscus

Activity: Hibiscus flowers and leaves are rich in amino acids and mucilage. They nourish the hair, stimulate hair growth, prevent dryness, and condition the scalp. Hibiscus also helps in controlling frizz and adds natural shine to hair.

6) Bhringraj[26]

Biological Source:*Eclipta alba*

Synonyms: False Daisy, Keshraj

Activity: Bhringraj is widely used in Ayurvedic medicine for treating hair loss and promoting hair growth. It improves blood circulation to the scalp and helps in revitalizing hair follicles. It also helps in reducing premature greying.

7) Aloe Vera[27]

Biological Source:*Aloe barbadensis miller*

Synonyms: Ghritkumari

Activity: Aloe vera soothes the scalp, reduces dandruff, and provides deep hydration to hair. It also contains enzymes that help repair dead skin cells on the scalp and promote healthy hair growth.

8) Tulsi (Holy Basil)[28]

Biological Source:*Ocimum sanctum*

Synonyms: Holy Basil

Activity: Tulsi has antimicrobial and antioxidant properties. It purifies the scalp, reduces itchiness and dandruff, and strengthens hair strands. Its adaptogenic nature helps the scalp combat stress-induced hair fall.

9) Fenugreek[29]

Biological Source:*Trigonella foenum-graecum*

Synonyms: Methi

Activity: Fenugreek seeds are rich in proteins, nicotinic acid, and lecithin. They help in reducing hair fall, dandruff, and dryness. The mucilage in fenugreek adds natural shine and softness to hair.

10) Brahmi[30]

Biological Source:*Bacopa monnieri*

Synonyms: Water Hyssop

Activity: Brahmi strengthens hair roots, nourishes the scalp, and reduces flakiness. It is also used to soothe the scalp and promote thicker, fuller hair by rejuvenating hair follicles.

IV. EVALUATION TEST[31-35]

A number of assessment criteria are evaluated in order to guarantee the herbal shampoo's effectiveness, safety, and acceptance. Standardizing the formulation, verifying the stability of the product, and evaluating its performance all depend on these tests.

1) Organoleptic Assessment

- First, the prepared shampoo is assessed for physical attributes like:
  Color: It should be consistent and eye-catching.
  Odour: It should smell nice and herbal, not artificial or unpleasant.
  Look: It should be uniform in appearance, devoid of any lumps or separation.
  Texture: Depending on formulation, it might be slightly viscous or smooth and gel-like.

2) Measurement of pH

- One important factor influencing scalp compatibility is the shampoo's pH.
- Method: The pH of a 10% shampoo solution (shampoo diluted in distilled water) is measured using a digital pH meter.
- The ideal range is between 4.5 and 6.5 to avoid dryness or irritation and to match the pH of the scalp naturally.

3) Measurement of Viscosity

- The consistency and simplicity of use of the shampoo are determined by its viscosity.
  Method: Measured using an appropriate rotating viscometer or a Brookfield viscometer.
  Note: The thickness of the shampoo should be reasonable, meaning it shouldn't be too thick or runny.

4) Foaming Ability and Foam Stability

Foaming capacity gives an idea of cleansing efficiency.

- Method: Shake test—1 gm of shampoo is mixed with 20 mL of distilled water in a graduated cylinder and shaken vigorously.
- Foam Height Measurement: The height of foam is measured immediately and again after 5 minutes to check foam stability

5) Dirt Dispersion Test

This test checks whether the shampoo can hold dirt in the foam and prevent it from redepositing on the hair.

- Method: A drop of India ink is added to the shampoo solution. The mixture is shaken and observed.
- Result Interpretation: If the ink remains in the foam, it indicates poor dirt dispersion. If the ink moves to the water layer, it signifies good cleansing efficiency.

6) Surface Tension Measurement

Lower surface tension enhances wetting and spreading properties of shampoo.

- Method: A stalagmometer or drop-counting method is used to calculate surface tension.
- Ideal Value: Should be significantly lower than pure water (72 dynes/cm), ideally around 35–40 dynes/cm.

7) Wetting Time Test

This test determines how quickly the shampoo wets hair strands or wool threads.

- Method: A 1% shampoo solution is prepared. A standard wool thread is dropped into it, and the time taken to sink is recorded.
- Shorter Time = Better Wetting.

8) Solid Content Determination

This reflects the concentration of active ingredients.

- Method: 4 g of shampoo is evaporated in a dish at 105°C until a constant weight is achieved.
- Ideal Result: Should be between 20–30% solid content.

9) Conditioning Performance

This test evaluates the after-feel, smoothness, shine, and ease of combing post-application.

- Method: A trained panel or volunteers assess hair feel after drying.
- Parameters: Detangling ease, softness, non-sticky finish, and natural shine are rated

10) Microbial Load Test

Ensures that the herbal formulation is free from microbial contamination.

- Method: Total plate count method is used to identify and quantify microbial colonies.
- Requirement: Should comply with pharmacopeial limits for topical products.

V. FUTURE SCOPE OF STUDY[36-40]

A vibrant and developing field of study in the pharmaceutical and cosmetics sectors is the creation and assessment of herbal shampoos. Future studies have enormous promise in a number of crucial areas as customer demand for sustainable, natural, and chemical-free products rises:

1) Sophisticated Standardisation and Extraction Methods

To increase the production and effectiveness of phytoconstituents from plants, contemporary extraction techniques such as ultrasonic extraction, microwave-assisted extraction, and supercritical fluid extraction can be used. Herbal shampoo compositions are guaranteed to be consistent and reproducible through the standardisation of active ingredients.

2) Including Innovative Herbal Components

The range of advantages provided by herbal shampoos can be expanded by research into lesser-known and underutilised medicinal plants. Novel plants with antibacterial, antifungal, or hair-strengthening qualities can be found with the use of ethnobotanical research and traditional knowledge.

3) Creation of Herbal Shampoos with Several Uses

Future formulas could include many advantages into one solution, such conditioning, UV protection, anti-dandruff, anti-hair fall, and scalp calming. Combining herbs with different pharmacological activities can help achieve this.

4) Utilising Nanotechnology

To improve the solubility, stability, and penetration of herbal actives, herbal shampoos can incorporate nanocarriers such liposomes, nanoemulsions, and phytosomes. As a result, bioactives may be delivered to hair follicles and scalp tissues more precisely and efficiently.

5) Customised Herbal Hair Treatment

Customised herbal shampoos based on each person's unique scalp type, hair condition, and genetic profile may be created thanks to advancements in genomics and dermatological diagnostics. Customer satisfaction and treatment results may be improved by this personalisation.

6) Dermatological and Clinical Trials

Currently, the majority of herbal shampoos rely on conventional wisdom and limited testing. In the future, efficacy, safety, and consumer perception can be confirmed by thorough clinical trials and dermatological research. This will improve market credibility and regulatory approval.

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7) Technologies for Green Formulation

In keeping with the expanding "green beauty" movement, future research may concentrate on shampoo formulations that are entirely biodegradable and environmentally benign, devoid of artificial perfumes, preservatives, and components originating from animals.

8) Examining Herbal Combinations

Stronger, more potent formulations could result from additional research into the synergistic effects of herbal mixtures. Optimising the therapeutic potential of polyherbal shampoos will be made easier with an understanding of the interactions between active phytochemicals.

9) Ingenious Preservation and Packaging

To extend shelf life and lessen environmental effect, natural preservatives like grapefruit seed extract or rosemary extract can be used, as well as clever and sustainable packaging made of recyclable, biodegradable, and UV-protective materials.

10) International Standards and the Regulatory Framework

Harmonization with international regulatory requirements for herbal cosmetics must also be a focus of future research. Creating product dossiers, safety profiles, and toxicological evaluations will be essential for breaking into foreign markets.

VI. CONCLUSION

The creation and assessment of herbal shampoo demonstrate the substantial potential of natural components in contemporary hair care products. Compared to traditional synthetic shampoos, which frequently contain harsh surfactants, chemical preservatives, and irritants, herbal shampoos provide a safer and more palatable option for the skin. The composition offers a comprehensive approach to scalp and hair health by combining cleaning, conditioning, antibacterial, and nourishing characteristics with herbs including Reetha, Shikakai, Amla, Neem, and Hibiscus.

The new study emphasizes how well herbal extracts work to improve hair texture, maintain scalp hygiene, and treat typical hair issues including oiliness, dandruff, and hair loss.

The product's physicochemical and cosmetic stability was confirmed by the findings that evaluation criteria such pH, viscosity, foaming ability, filth dispersion, surface tension, and conditioning effectiveness were all within acceptable levels. These results provide credence to the viability of herbal shampoo as a consumer-favored and economically feasible substitute in the personal care sector.

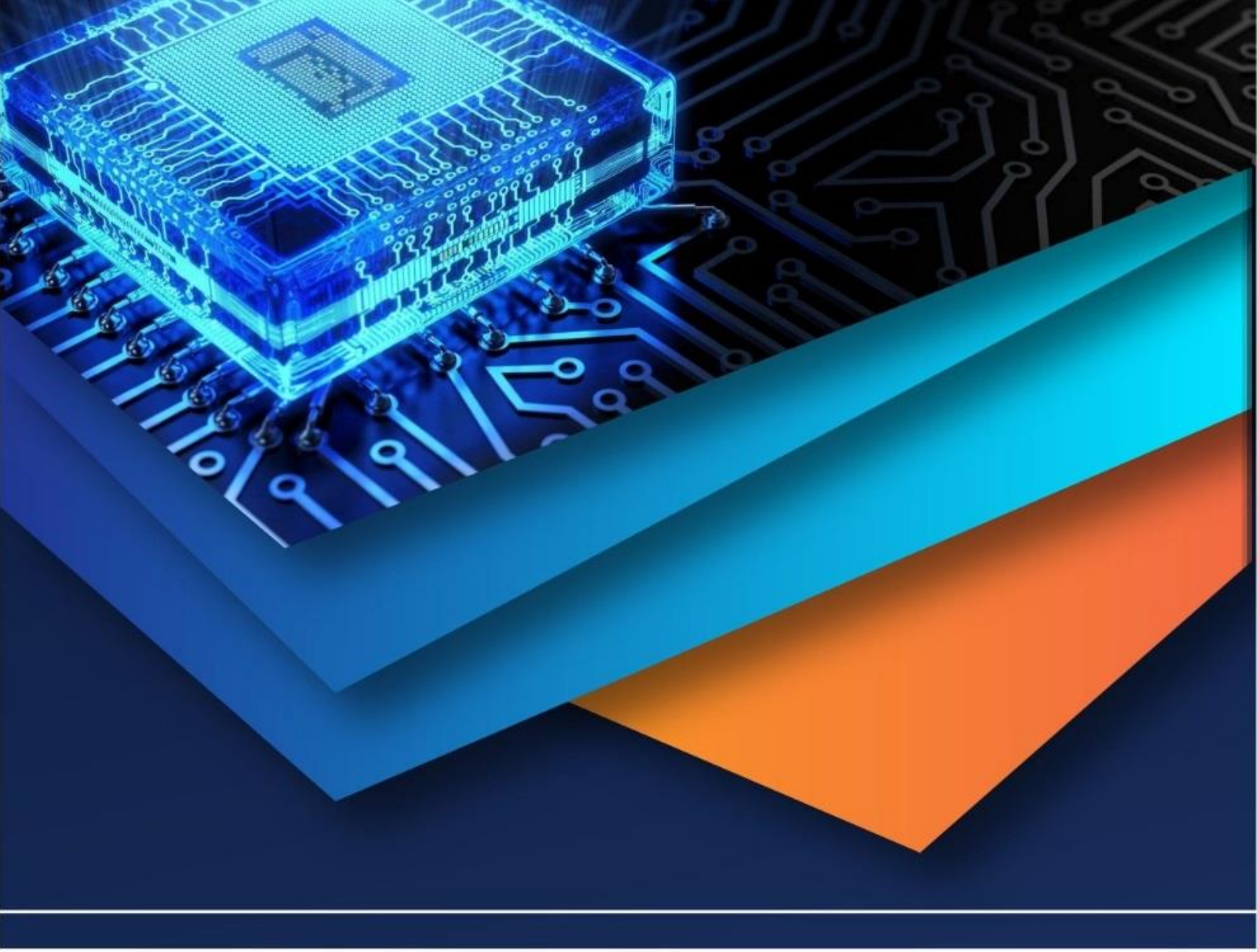
To sum up, herbal shampoo is a noteworthy example of a sustainable and health-conscious hair care innovation. It offers customers a product that is safe, effective, and ecologically conscious by bridging the gap between traditional herbal knowledge and scientific formulation processes. Herbal shampoos have the potential to revolutionize hair care and cosmetic wellbeing in the years to come with further study, clinical validation, and the use of contemporary technology.

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