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A Review on: Formulation and Evaluation of Herbal Hair Dye

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ABSTRACT:

The study aims to formulate and evaluate a herbal hair dye using natural ingredients known for their coloring and hair-nourishing properties. With a growing concern over the adverse effects of synthetic hair dyes, this research focuses on using henna, fenugreek, beetroot, clove, bhringraj, hibiscus, amla, neem, and curry leaves, which possess various health benefits for hair. The formulation was prepared by mixing these ingredients to achieve a uniform blend, which was then tested for its organoleptic, physico-chemical, and phytochemical properties. The results indicate that the herbal dye formulation is a safer alternative to synthetic dyes, offering not only effective coloring but also promoting hair growth and health.

INTRODUCTION:

The primary physical characteristic shared by all mammals is their hair, or Pili. With the exception of the palms and soles of the hands, it covers the majority of the body. Foot and a few sections of the external genitalia. The hair distribution pattern and thickness are dependent on based on hormonal and genetic factors. Sunlight and harm are protected from by the hair on the head. While the hair on the brows shields the eyes from extraneous material particles. The process of changing the color of hair is known as hair coloring or hair dyeing.The main aesthetic justifications for this are to hide white or gray hair, to switch to a hue thought to be more sophisticated or optimal, or to restore the natural hair color after it has been been dyed with the assistance of a hair stylist processes like sun bleaching. Hair color provides a seem of more voluminous, thicker hair. In this instance It's always a fantastic idea to think of It offers power for hair color that is semi-everlasting. in your hair and gives them a healthier appearance. Our hair is exposed to exclusive daily environmental elements, such as filthy air, excessive heat, filth, and changes in temperature, among other things. These can have an adverse impact on our scalp.[1] The usage of color in hair is not recent. Egyptians employed vegetable dyes to practice the art of hair coloring as early as 5000 BC.[2] Synthetic hair colors are said to induce skin and other skin-related disorders in contrast to natural hair dyes. The manufacturing process poses a risk to the health of those engaged, and its applications result in contamination of the environment and possible negative impacts on the product's users. Fearing negative consequences from the The use of synthetic colors has decreased globally due to health-conscious consumers' concerns. must get over a number of legal obstacles before arriving at its destination.[3] Colorants can be categorized as either permanent or transient. Temporary hair coloring allows for easy removal of the color. The application of aromatic diamine, hydric phenols, or polycompounds is required for permanent hair coloring. such as the formulation's para-phenylenediamine. Constant use of these substances Using dye on natural hair has numerous negative effects, including erythrema, skin irritation, skin cancer and hair loss or damage. Additional substances included in hair dyes serve as modifiers. which operate to adjust the shade or stabilize the dye pigments. Antioxidants shield the color from airborne oxidation. Sodium sulfite is the most often utilized. The pH of the dye formula is adjusted by adding alkalizers since the dye functions best in an environment that is quite alkaline. One typical alkalizer is ammonium hydroxide. Beyond these fundamental substances, numerous more Chemicals are added to a manufacturer's formula to give it unique properties. To add color When using oxidative dye technique on human hair, the hair is often treated with a combination of two types of hair coloring agents: oxidative and oxidizing. The most common is hydrogen peroxide. frequently employed oxidizing agent. But apart from oxidizing the oxidative coloring Furthermore, treating hair with hydrogen peroxide can also solubilize and decolorize colored melanin component in hair, which can result in brittleness and other undesirable hair traits.[4] Herbal remedies are emphasized as a means of overcoming these negative consequences. This gave us the idea to create a herbal hair color. Herbs such as bibhitika, madayantika, nilika, and bhringraj Black catechu and walnut are well-known for darkening hair.[5] The perfect hair should be black, unctuous, and have strong roots; herbal products can safely fulfill these requirements.[6]

ADVANTAGES OF HERBAL HAIR DYE:

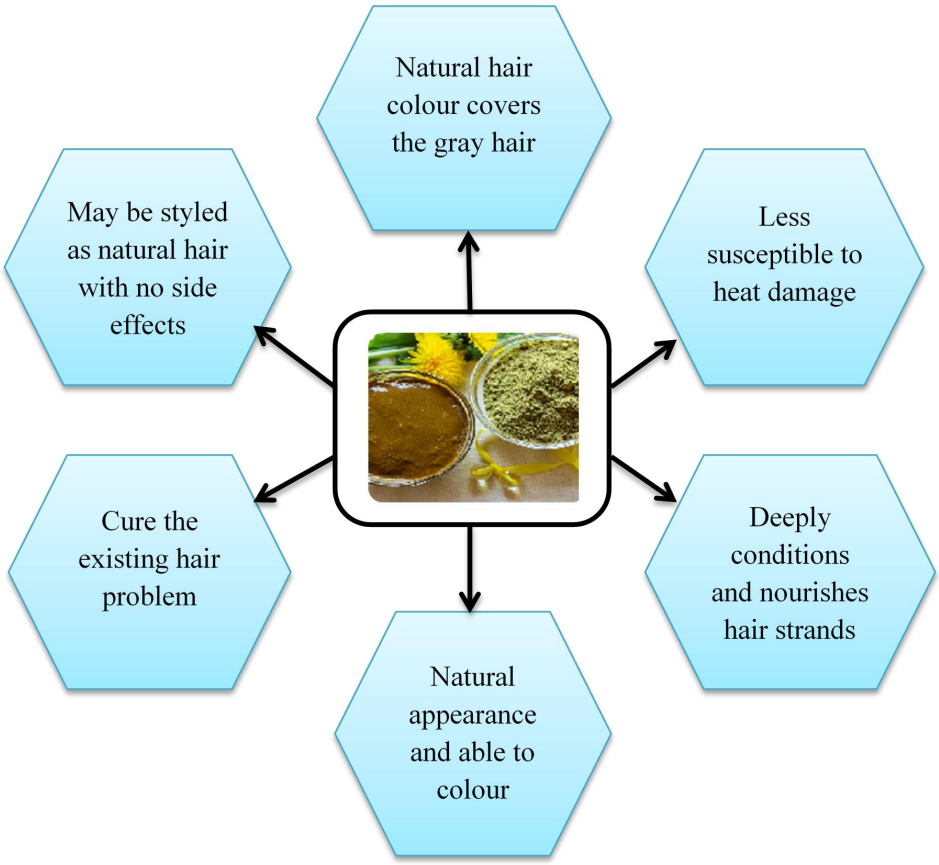


Fig.1:- Advantages of herbal hair dye

INGREDIENTS USED IN THE FORMULATION OF HERBAL HAIR DYE:

1. Henna:

Fig.2: - Henna

The primary coloring agent in henna is called "Lawson," a reddish-orange compound with a collar that is found in dried leaves at a concentration of 1.5% to 1.7% w/w. It is recommended to use Lawson as a non-oxidizing hair coloring agent as little as possible. 1.5% concentration in the cosmetic item.[7] As organic mordents, other henna ingredients including gallic acid and flavonoids aid in the coloring process. The henna paste has the right viscosity for hair attachment because of the carbohydrates in it.[8] Additionally, henna possesses antifungal properties against Malassezia species, which are the causal agents of dandruff.[9] Henna prevents premature hair loss and graying of the hair by balancing the pH of the scalp.[10]

Common name	Henna
Scientific name	Lawsonia inermis
Kingdom	Plantae
Family	Lythraceae
Biological source	Leaves of the henna plant
Chemical constituent	Lawsone(2-hydroxy-1-4 napthoquine)

Uses:

1) Henna balances the scalp's acid-alkaline balance and mends damaged hair strands.
2) The best henna for hair coloring is free of ammonia, toxins, and chemicals.
3) It is also used to shield hair from dust and the sun. Hair can be strengthened with henna as well.
4) It works well for treating scalp infections and dandruff. [20]

Pharmacological action :

The dyeing effect of henna happens through oxidation. When henna paste is mixed with water, lawsone is released. Upon exposure to air and heat, it oxidizes, deepening the stain and bonding more effectively with keratin.[29]

2. Fenugreek:

Fig.3: - Fenugreek

Fenugreek has a high protein level that may promote hair development, and it also has a strong flavonoid content that acts as an antioxidant by scavenging free radicals and halting hair loss.[11] Additionally, seed extract is applied as a hair cleaner.[12]

Common name	Fenugreek
Scientific name	Trigonella foenum, graecum
kingdom	plantae
family	fabaceae
Biological source	Seed and leaves of the fenugreek plant
Chemical constituent	Alkaloids (e.g trigoneosine), saponins, flavonoids (e.g vitexin), coumarins fiber, essential oil (e.g fenchone)

Uses:

1) This herb has laxative qualities and a dry, warm character.

2) Hair can benefit from its oil.

3) Fenugreek seed mucilage relieves striae caused by cold, particularly when combined with flower oil.

4) It can be used as a shampoo to treat dandruff.

5) Fenugreek in a boiled form relieves coughing, helps soothe the throat and chest, and treats red spots under the eyes.[21]

Pharmacological action :

Fenugreek seeds contain compounds like diosgenin, which is a phytoestrogen. These compounds may promote hair growth by improving hair follicle health and scalp circulation. Although not a direct dyeing agent, improved scalp health can lead to stronger, more resilient hair, which enhances the effect of hair dye.[30]

3. Beetroot:

Fig.4 Beetroot

Beetroot is consisting of fresh root of beta vulgaris. Family Chenopodiodeae. It is made up of fresh beet vulgaris roots and uses synonous sugar beet, a root vegetable of sources. It commomly employed as liver dieases coloring agent.Fatty liver, high blood pressure, reducle the blood pressure Lowering the try gycerid level in blood. chemical ingredient betanin, beta balmic acid, trimethaglycine, indica zanthine.[13]

Common name	beetroot
Scientific name	Beta vulgaris
Kingdom	plantae
Family	Amaranthaceae
Biological source	Roots of the beetroot plant
Chemical constituent	Betalanins (e.g. betacyanin, betaxanthin), folate, vitamin c, fiber, antioxidants (e.g. flavonoids), nitrates

Uses:

1) You can use beetroot pigment as a culinary coloring.

2) Only suitable for use in ice cream and other confections due to its color change when heated, but it is inexpensive and has no known allergies. adverse consequence.

3) Strong and with a gorgeous red color akin to rice rubies, beetroot juice is believed to aid in blood purification.

4) It is rich in antioxidant, essential antidepressant, antibacterial, and anti-carcinogenic vitamins and minerals.[22]

Pharmacological action :

Beetroot is rich in betalains, particularly betacyanins (like betanin), which are responsible for its deep red color. These water-soluble pigments can temporarily stain hair, providing a reddish hue, especially on lighter hair shades. However, the dye effect is less permanent than synthetic dyes, and repeated applications may be needed to maintain the color.[31]

4. Clove:

Fig.5: - Clove

Cloves have tannins that give them a yellow color, are soluble in water, do not crystallize, and combine with the suspension's proteins.The creation of a brownish-yellow color is indicative of a natural hair coloring derived from cinnamon and clove. The mixture that generates the brightness hair gloss, color smoothness, and most preferred color.[14]

Common name	Clove
Scientific name	syzygium aramaticum
Kingdom	plantae
Family	myrtaceae
Biological source	Dried flower buds of the clove tree
Chemical constituent	Eugenol, beta caryophyllene, acetyl eugenol, vanillin, tannins,

Uses:

1) Cloves can be used in cooking and medicine, among other applications.
2) A useful culinary spice, cloves can be used to salad dressings, herbal teas, soups, onions, and tomatoes.
3) With its ability to combat bacteria, clove is a common ingredient in mouthwashes, dental creams, throat sprays, and tooth pastes.
4) Short-term dental cavity fillings are made with a mixture of zinc oxide and eugenol, the principal bioactive component of clove.
5) Moreover, it relieves painful gums. [23]

Pharmacological action :

The primary active compound in clove is eugenol, which has strong antioxidant, anti-inflammatory, and antimicrobial properties. Eugenol can help maintain scalp health by reducing irritation, inflammation, and potential infections. A healthy scalp promotes better hair growth and improves the absorption and retention of hair dye, ensuring the dye adheres evenly to the hair.[32]

5. Bhiringraj:

Fig.6: - Bhiringraj

Eclipa alba, which has been used for centuries to promote hair development, can be extracted and applied to the scalp to cause the hair to turn black.It's been cited as a component in the making of several poly herbal used as a catalyst for hair growth.used as a dandruff remedy, to create glossy, smooth hair.[15] to dye and encourage hair growth.

Common name	Bhringraj (or false daisy)
Scientific name	Eclipta prostrata
kingdom	Plantae
family	Asteraceae
Biological source	Leaves and aerial parts of the bhringraj plant
Chemical constituent	Wedelolactone, ecloptine, flavonoids (e.g. luteolin) triterpenoids, alkaloids, essential oil

Uses:

1) The plant is reportedly used as a tonic for the scalp to promote hair growth.
2) The drink is recommended to be used in conjunction with aromatic medications for anemia, cataracts, and cough.
3) In addition to stimulating digestion, it is also said to be used to increase appetite.
4) Honey should be added to the drink in order to help youngsters with upper respiratory congestion.
5) According to reports, Bhrungraja is used as a deobstruent for enhanced bile flow, as well as to protect parenchymatous liver tissue in cases of viral hepatitis and numerous other disorders involving hepatic hypertrophy.[24]

Pharmacological action :

Bhringraj is known to promote melanin production, which is responsible for the natural pigmentation of hair. By stimulating melanin synthesis, Bhringraj helps maintain the natural color of hair and may delay premature graying. When used alongside hair dye, it can enhance the depth and richness of dark colors.[33]

6. Hibiscus:

Fig.7: - Hibiscus

Hibiscus rosa sinesis is a member of the Malavaceae family. According to legend, this plant's blossoms are used to stimulate hair growth. It promotes healthy hair growth. characteristics through an increase in follicular size and length of the anagen stage.[16]

Common name	Hibiscus
Scientific name	Hibiscus sabdariffa
kingdom	plantae
family	Malvaceae
Biological source	Flowers, leaves ,calyces of the hibiscus plants
Chemical constituent	Hibiscus acid, antrocyanins (e. g.delphinidin), flavonoids (e.g. quercetin), organic acids

Uses:

1) It is of the highest caliber for stimulating hair growth.
2) Hibiscus is clearly enhanced with dietary B1, vitamin C, riboflavin, calcium, phosphorus, iron, and Vitamin N, which helps to encourage thicker hair growth and reduction premature graying of the hair.
3) This blossom is applied to manage dandruff.
4) Hibiscus is well-known for its ability to generate antioxidants. anthocyanins Flavonoids along with various phenolic mixtures.
5) It can be used to condition hair to revitalize it.[25]

Pharmacological action :

Hibiscus petals, especially the red varieties, contain anthocyanins, flavonoids, and other pigments that provide a natural reddish hue when applied to hair. These pigments can act as a mild, temporary hair dye, adding subtle red or purple tones to the hair. Anthocyanins are water-soluble and help in the deposition of color on the hair strands.[34]

7. Amla:

Fig.8: - Amla

Because of its high vitamin C content and tannin content, it is one of the main ingredients in hair care products and helps to prevent hair loss caused by external surroundings. Amla promotes hair retention. strengthens the hair follicle and adds color.Because of its high vitamin C content, It prevents aging, is used to treat gray hair, and can cause development of hair.[17]

Common name	Amala
Scientific name	Phyllantus embica
kingdom	Plantae
family	euphorbiaceae
Biological source	fruits
Chemical constituent	Vitamin c, tannins (ellagic acid) flavonoids

Uses:

1) Take care of your scalp.
2) Encourage the growth of healthy hair.
3) Enhance the henna hair dye's tone.
4) Reduce the amount of grays.
5) Cut down on dandruff.[26]

Pharmacological action :

Amla contains tannins and other polyphenolic compounds that help enhance and stabilize the color of herbal hair dyes, especially when used in combination with henna. It imparts a dark, rich tone to hair when used as a dye, and can deepen the color produced by other natural pigments.[35]

8. Neem:

Fig.9: - Neem

Azardirachta indica leaves, which belong to the Meliaceae family of neem, have benefits such as antibacterial and regenerative qualities. They also aid in reducing hair loss and improving hair growth by combining it with olive or coconut oil. Gives a healthy scalp is necessary for treating dandruff, growing hair, and Both seborrheic and psoriasis dermatitis as well as getting rid of head lice.[18]

Common name	Neem
Scientific name	Azadirachta indica
Kingdom	plantae
Family	Meliaceae
Biological source	Leaves, bark, seeds, and fruits of the neem tree
Chemical constituent	Azadirachtin, nimbidin, nimbolide, quercetin, flavonoids, terpenaids

Uses :

1) Control dandruff.
2) Helps to control the premature greying of your hair.
3) Antimicrobial agent.
4) It covers gray hair naturally .[27]

Pharmacological action :

Neem is rich in compounds such as azadirachtin, nimbin, and quercetin, which have potent antimicrobial and antifungal properties. This makes neem effective in treating dandruff, scalp infections, and other microbial conditions that can affect hair and scalp health. A healthy scalp provides a better base for hair dye application and enhances color retention.[36]

9. Curry leaves:

Fig.10: - Curry leaves

Murraya koenigii leaves, which belong to the Rutaceae family, are used as a hair tonic to preserve hair tone and growth.[19]

Common name	Curry leaf
Scientific name	Murraya koenigii
kingdom	plantae
family	rutaceae
Biological source	Leaves
Chemical constituents	Alkaloids (murrayanine) flavonoids (quercetin, kaempferol) essential oil (beta caryophyllene) and phenolic compounds (gallic acid)

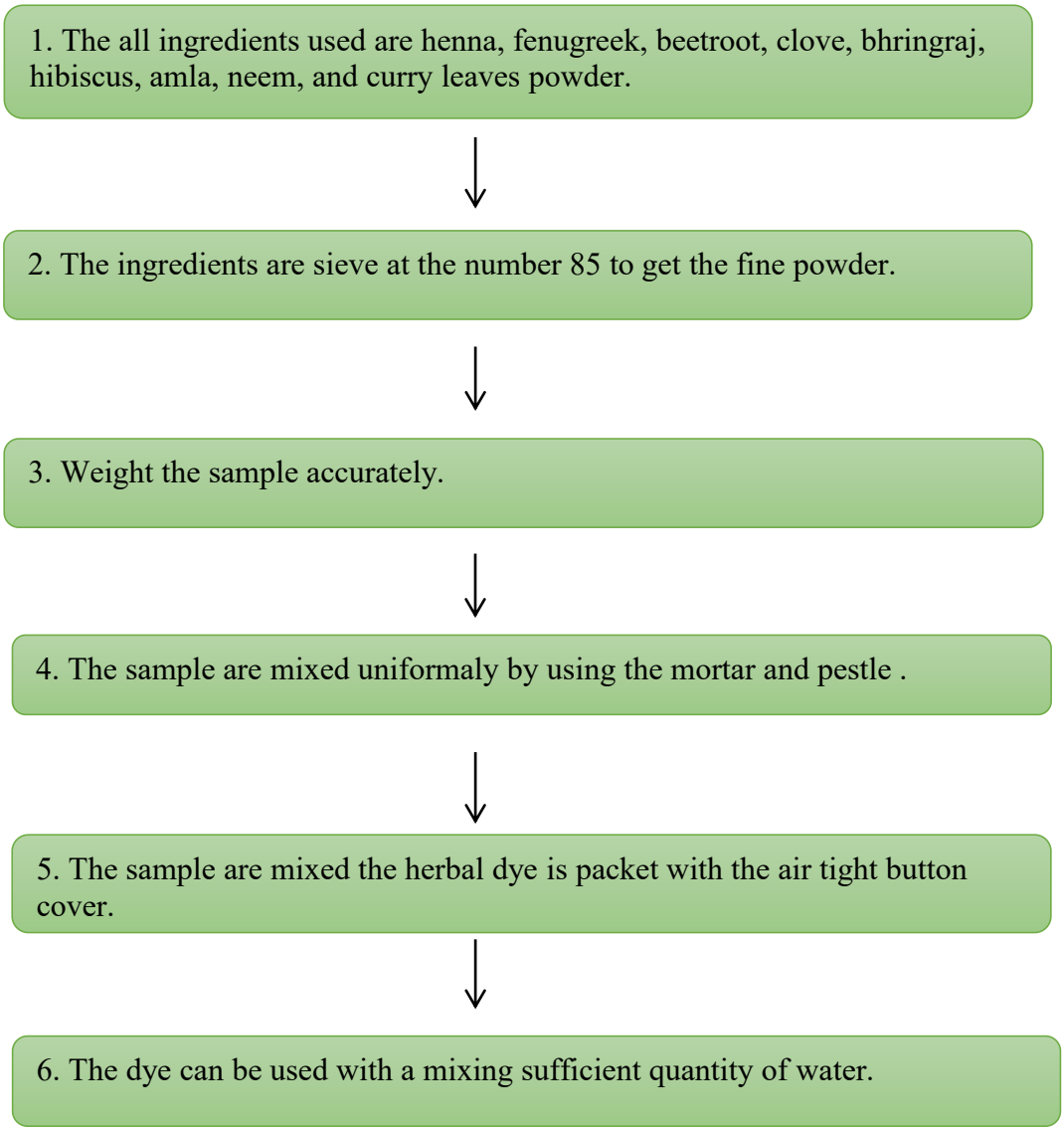
Uses :

1) Iron, vitamin C, and antioxidants are abundant in curry leaves.
2) It can stop hair leaves and fortify the roots of the hair.
3) Manage the loss of hair.
4) Fix the damaged, frizzy hair.
5) High in folic acid beneficial to hair and skin.[28]

Pharmacological action :

One of the most notable benefits of curry leaves is their ability to prevent premature greying of hair. They contain antioxidants and iron, which help in maintaining the natural pigmentation of hair. By reducing oxidative stress on the hair follicles, curry leaves slow down the depletion of the melanin pigment, helping to maintain natural hair color for a longer time.[37]

METHOD OF PREPARATION OF HERBAL HAIR DYE:



EVALUATION OF HERBAL HAIR DYE :

1. **Organoleptic evaluation:**

a) Colour of formulation

b) Odour of Formulation

c) Appearance

d) Texture

2. Physio-chemical evaluation:

The herbal hair dye's physical and chemical characteristics were assessed to ascertain its pH, moisture content, compatibility, and the quantity of inorganic material found within it.

3. Phytochemical evaluation:

Molisch's test:

a) Place 1 grams of the sample in a dry test tube.

b) In a sample, take two milliliters of distilled water.

c) Add two to three drops of Molisch's reagent to the mixture.

d) Note any color shift where two layers converge.

Volatile oil test:

a) Sample + alcoholic solution of Sudan III

b) Look at the color

Mayer's test (For alkaloid):

a) Sample + Mayer's reagent

b) Look at the color

4. Rheological evaluation:

Bulk Density:

Precisely weigh 5 grams of powdered color, then transfer it into a 100 milliliter measuring cylinder. Read the unclear apparent after carefully leveling the powder blend without compacting it. worth.

Bulk density= Bulk mass/Bulk volume

Tapped Density:

Precisely weigh 5g of powdered color, then transfer it into a 100ml measuring cylinder.

Next, using mechanical tapped thickness, carefully tap the chamber holding the example by elevating the chamber and allowing it to fall under its own weight. analyzer at a nominal speed of 300 droplets per second.

Tapped Density = Mass/Tapped volume

% Carr's index:

(Tapped density- Bulk density)/ tapped density*100

Housner's Ratio:

Tapped density/Bulk density

Patch test:

This usually entails identifying the small amount of wet hair color arrangement behind the ear on or inside the elbow in an area 1 sq. cm and allowing it to dry. The If a sign of disruption or feeling unwell is observed, any A pre-arranged hair pack was applied to the area in small, estimated amounts at the appropriate times. Angry, Redness and enlargement were examined, and standard stretch, if any, for up to 24 hours.

Stability test:

For the duration of a month, the prearranged plan's solidity was tested by storing it at different temperatures for an hour. Pressed glass vials containing definitions were stored at different temperatures for the real limits, such as surface, pH, tone, scent, and smooth out.[38]

RESULT:

The formulated herbal hair dye were evaluated based on its organoleptic (color, odor, appearance, and texture), physico-chemical (pH, moisture content), and phytochemical properties. The bulk density, tapped density, Carr's index, and Housner's ratio indicated good flow properties, while the patch and stability tests confirmed the absence of irritation and a stable formulation under various conditions. The dye displayed favorable coloring effects with a smooth texture and acceptable odor, making it user-friendly. Phytochemical tests showed the presence of key compounds such as lawsone, flavonoids, and saponins, which are essential for both hair coloring and nourishment.

DISCUSSION:

The herbal hair dye formulation shows promise as a natural alternative to synthetic dyes, particularly for users concerned about adverse effects like skin irritation and hair damage. Henna, being the primary coloring agent, provides an effective base for the dye, while other ingredients such as fenugreek and bhringraj contribute to hair strengthening and growth promotion. The evaluation tests revealed that the dye possesses good physical stability and no adverse reactions, ensuring it can be safely applied to various hair types. Furthermore, the antioxidants and vitamins in ingredients like hibiscus and beetroot contribute to overall hair health by preventing premature graying and maintaining a healthy scalp. The formulation's success lies in the synergistic effects of the herbal ingredients, which not only provide color but also condition and strengthen the hair. The absence of synthetic chemicals makes this dye environmentally friendly and suitable for consumers seeking non-toxic hair care products.

CONCLUSION:

The herbal hair dye formulated in this study demonstrates significant potential as a natural and safe alternative to commercial synthetic hair dyes. The dye effectively colors hair while offering additional health benefits, such as strengthening hair, preventing dandruff, and promoting growth. With further optimization and large-scale testing, this herbal dye could become a popular choice among consumers prioritizing natural, sustainable hair care solutions.

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