

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Research on Herbal Hair Dye

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ABSTRACT

This study pioneers the development of plant-based hair dyes using henna, amla, reetha, indigo, and hibiscus—botanicals renowned in traditional medicine for their coloring and therapeutic properties. With rising awareness of the toxicity, environmental harm, and scalp damage linked to synthetic dyes, this research offers a safe, biodegradable solution that merges cosmetic appeal with hair health benefits.

The herbal formulations were engineered to:

Impart long-lasting, natural color without harsh chemicals.

Strengthen hair follicles and reduce breakage.

Combat scalp conditions like dandruff and premature graying.

Rigorous testing evaluated color consistency, pH balance, antioxidant content, and viscosity, confirming their efficacy as high-performance, eco-conscious alternatives. The results underscore the potential of herbal dyes to revolutionize the beauty industry by prioritizing sustainability, safety, and holistic care.

Introduction-

Hair colouring is a process used to modify the natural shade of hair. Most individuals choose to dye their hair to hide white or grey strands or to revive their natural tone lost due to sun exposure or chemical use. Herbal dyes, typically crafted from ingredients like henna, indigo, and amla, are not only used for colour but also provide nourishment to the hair and scalp.

A large portion of people—estimated around 70%—experience issues such as premature greying and hair thinning. The age at which hair begins to turn grey is primarily linked to genetic traits. Natural colouring agents have been in use since ancient times. Our ancestors often extracted pigments from various parts of plants, including roots, leaves, stems, and flowers, to colour hair, textiles, and fabrics.

Traditional herbs such as amla, henna, reetha, shikakai, curry leaves, and methi seeds have long been used for enhancing hair health, supporting hair growth, and providing a natural alternative to synthetic colourants. With the rise of eco-awareness, interest in plant-based dyes has grown again, particularly due to their minimal environmental impact and safer use in cosmetic products.

These natural hair dye formulations not only help with colouring but also contribute to hair growth and strength. Since they are derived from plant sources, they are less likely to cause scalp irritation or dryness compared to synthetic options. They also tend to be free from harmful substances, making them suitable for routine application.

Chemical dyes, in contrast, often contain harsh ingredients such as ammonia, peroxide, and para-phenylenediamine (PPD), which can lead to adverse reactions or long-term damage. On the other hand, herbal dyes contain natural compounds like tannins that act as bonding agents, improving dye absorption and ensuring longer-lasting colour.

Hair dye products may also include additional components in small amounts, such as surfactants, alkalizing agents, and fragrances to enhance usability and application results. Natural ingredients are generally more accessible, cost-effective, and come with a lower risk of harmful side effects.

Hair discolouration can result from multiple causes such as hereditary factors, environmental pollutants, or aging. Although chemical-based dyes provide a wide colour range, they may cause allergies or skin sensitivity. Some reports even suggest a possible connection between prolonged use of synthetic dyes and certain health risks, including cancer. As a result, there is increasing interest in developing safer, plant-based alternatives that support both hair care and health.

Herbal hair dye

Definition -

Herbal hair dye is a hair dye made from natural ingredients like herbs, fruits, and plant extracts, instead of chemical-based ingredients. It's often considered a gentler, more eco-friendly alternative to traditional hair dyes.

Classification -

1. Temporary

These hair colors are used to color the hair temporarily. The colorants employed do not permeate the hair or surroundings. Easy to rinse off water after shampooing. For temporary hair coloring, use a Puffer Spray with finely crushed metals. To add temporary color, use powders, setting lotions, or crayons. To create temporary hair coloring, use the leuco derivative of a basic dye, such as crystal violet.

2. Semi permanent

Semi-permanent dyes typically contain nitrophenylene diamines, nitroaminophenes, or both Aminoantrhaquinones. Shampoo is the most commonly used base. Adding a solvent can improve colorant performance. Primary dyes have a natural affinity for hair due to their cationic properties.

3. Permanent

In a slow oxidation process, the principal intermediates react chemically with modifiers in a coupling reaction. Hair can be dyed with a lighter tint than it was originally with permanent dye methods. These dyes can mask individual hair color differences. Extremely successful on mixed-race black and white hair. They do cause some hair damage.

Advantages

- Use more natural substances and no chemicals to color your hair
- Gray hair is covered by natural hair color without any negative side effects.
- Deeply nourishes and conditions hair strands from the inside out.
- Treat the current hair issues and Fit all sorts of hair.
- It has Minimal effects on the environment and is Accessible in an array of color tones

Disadvantage

- In certain cases, natural hair may potentially be detrimental.
- The availability of natural colors is another problem.
- Producing it can be challenging due to the availability of raw resources

Application of herbal hair dye

The main constituent used is henna which gives an orangish colour to hair. Different other natural compounds were mixed to get a darker color as well as to protect the hairThe formulation also prevents hair from premature greying, hair fall, cleaning of dandruff, etc.Spread the coloring mixture evenly across all of your hair.

Benefits of Herbal Hair Dyes

- Reduced allergic reaction Herbal hair dyes are less likely to cause allergies reactions to cause allergic reaction or scalp irritation due to their hypoallergenic nature, making them suitable for the individuals with sensitive skin or allergies. It also caused dry scally, Bumpy, Blister, inflamed.
- Natural ingredient Herbal hair dyes are less likely to cause allergic reaction or scalp irritation due to their hypoallergic nature, making them suitable for individual with sensitive skin or allergies.
- Nourishing Properties Many botanical ingredients used in the herbal hair dyes, such as henna and amla, contain natural conditioning agents that help nourish and strengthen the hair, leaving it soft, shiny, and more resilient.

4) Long- lasting colour- While herbal haor dyes may require more frequent application compared to synthetic dyes, they often provide longlasting colour that gradually fades without harsh lines or root.

• Uses of Hair Dye

- It is used for cosmetic purposes to change hair colour, cover Gray hair.
- Used to cover white hair or postpone graying.
- It is used to protect injure hair shaft
- It is also beneficial in the removal of excess oil form the scalp and condition the hair well.
- It is good for the growth of hair and fights against dandruff.
- It is used to improving the overall quality and texture of hair.

Aim and objective -

Aim – Formulation and evaluation of herbal hair dye.

Objective -

To formulate herbal hair dye by using herbs such as Henna, Amla, Reetha, Shikakai, Hibiscus, Neem, Tea, Tulsi, Brahmi, Methi, Orange peel powder etc.

To check organoleptic, physicochemical, rheological aspects of drug present in the formulation. To avoid the common side effect of chemical used in synthesis hair dyes. To make hairs shiny, lustrous, soft, and colourful. To conduct different evaluation test for herbal hair dye.

Plane of work

- 1. Select herbs-
- 2. Choose herbs based on literature review. Some common herbs used in herbal hair dye include henna, amla, reetha, shikakai, hibiscus, tulsi, neem, and black tea.
- 3. Collect and prepare herbs -
- 4. Collect the herbs from a local market and prepare them in powdered form. For example, you can wash and peel the outer surface of fresh aloe vera leaves, and collect the inner mass.
- 5. Weigh and sieve -Weigh the herbs and pass them through a sieve to get uniform-sized particles
- 6. Mix- Mix the herbs together to form a homogeneous powder.
- 7. Apply -Apply the paste to white hair samples for a set amount of time, then wash and evaluate the

Material used in Herbal Dyes -

1. Henna -



• Synonyms- Mehndi, Amber, Chestnut.

- Biological Source- Lawsonia inermis L. commonly known as Henna family Lythraceae
- Geographical Source- native to North Africa and South-West Asia
- Chemical Constituent- The main chemical constituent is Lawsone. The Lowsone level in dried drug is 1%. Henna leaf also contain Flavonoids, Coumarins and Xanthene's.

Henna a natural dye derived from the leaves of the lawsonia inermis plant plays a pivotal role in herbal hair dyes formulation. Henna serves not only as a colouring agent but also as a conditioner and scalp treatment. Henna's natural conditioning properties penetrate the hair shaft, impairing rich, long-lasting colour while simultaneously strengthening and nourishing the hair. Henna prevents premature hair fall by balancing the pH of the scalp and graying of the hair. Henna leaf paste is used for alleviating Jaundice, Skin diseases, Smallpox.

2.Reetha-



- Synonyms- Soapberry, Aritha, Washnut
- Biological source- Sapindus mukorossi belongs to Family- Sapindaceae
- Geographical source Reetha is found in the hilly regions of the Himalayas
- Chemical constituent The main chemical constituent are saponins, sugars
- Advantages- Cleansing the scalp naturally, preventing hair loss, promoting stronger hair, Reducing dandruff.

Its fruit is rich in vitamin A,D,E,K, Saponin,Sugars,Fatty acids, mucilage. Reetha extract is useful for the promotion of hair growth and reduced dandruff. Extract of fruit coat acts as a natural shampoo. Therefore is used in herbal shampoos in the form as natural hair care product since older times. This plant is enriched with saponins, which makes the hair healthy, shiny, and lustrous when used on regular basis. Reetha as soapnuts or washingnuts, play an important place as natural hair care product.

3.Coffee -



• Synonyms- Brew, Cuppa, Bitter Juice.

- Biological source- The biological source of coffee is its dried ripe seed belongs to family- Rubiaceous.
- Geographical source- Latin America, Eastern Africa, Asia and Arabia.
- Chemical Constituent- The main constituent of coffee are caffeine, Tannin, Fixed oil, Carbohydrate, and proteins. It contains 2-3 % caffeine, 3-5 % tannin, 13% protein and 10-15 % fixed oils.
- Advantages- Boost hair growth, Reduces hair loss,

The herbal drugs like coffee powder obtained from its seeds are used as hair colorant. Coffee, beyond its role as a morning pick-me-up, its gaining recognition for its potential benefits in herbal hair dyes. When incorporated into these formulation, coffee acts as a natural dyeing agent. Its rich in antioxidants and caffeine, coffee not only adds colour to the hair but also promotes scalp health and hair growth. Potential cosmetic benefits make coffee a valuable addition to herbal hair dye formulation.

4. Indigo -



- Synonyms Azure, Berly, Navy.
- Biological source Extracted from the small, green leaves of the Indigofera plant belongs to the family Fabaceae
- Geographical source Mesopotamia, Egypt, Britain, Mesoamerica, Peru, Iran
- Chemical Constituent Indirubin, Isatin, Isoindigo, Hydroxyindirubin,

Indigo, a natural dye derived from the leaves of the Indigofera tinctoria plant, is commonly used in herbal hair dyes for its rich blue-black colour. When used in hair dyes, indigo can impart deep, cool-toned hues to the hair, ranging from dark browns to intense blacks. Indigo works by binding to the protein in the hair shaft, resulting in long-lasting colour that gradually fades over times. Often used in combination with henna another natural dye, indigo can help achieve a broader spectrum of colour, including shades of brown and burgundy

5.Shikakai -



- Synonyms Virala, Sari, Dipta.
- Biological source Acacia concinna belongs to family Mimosaceae.
- Geographical source Shikakai is grown in Southern Asia including India, Myanmar and Thailand.
- Chemical Constituent The main constituent are Lupeol, Spinaster acid, lactone and the natural sugars glucose, arabinose and rhamnose.
- Advantages- Controls hair fall, prevents dryness, Slows down premature graying of hair. Slows down premature graying of hair.

For the control of dandruff. Shikakai or acacia concinna, has rich amount of vitamin C, which is beneficial for hair. Shikakai naturally lowers the pH value and retain the natural oils of the hair and keeps them lustrous and healthy. Its also effective is strengthening and conditioning hair, Amla, reetha, and Shikakai compliment each other, therefore, they are mixed together to have healthy and lustrous hair.

1. Amla –



- Synonym Indian gooseberry, Embelic.
- Biological source Phyllanthus embica L belonging to family- Euphobiaceae.
- Geographical source Amla fruits are edible and are mainly found in region in India, China, Iran, Asia, Pakistan.
- Chemical Constituent Glucogallin, Punigluconin, emblicanin A, Chebulagic acid, Corilagin, Peduncluganin.
- Advantages- Upgrades the retention of calcium, Assisting with making better bone, teeth and nails, It keeps up with the hair tone and forestall untimely turning the gray.

Amla is the richest and concentrated from of Vitamin C along with tannin found among the plants. Whole fruit is used as an active ingredients in hair care preparation. The Vitamin C found in the fruit. It maintain the hair colour and prevents premature graying. Berries obtained from amla enhance the absorption of calcium, helping to make healthier bones, teeth, nails and hair. Itmaintain the hair colour and stops untimely graying. Strengthen the hair follicles.

7. Hibiscus –



- Synonyms- Hibiscus cannabinus, Indian hemp,
- Biological source- Hibiscus rosa-sinensis

• Graphical Source - The origins of Chinese hibiscus are disputed; it is likely from Southeast Asia, though some authorities point to Vanuatu in Oceania or various other tropical regions

• Chemical constituent -flavonoids, antho- cyanins, terpenoids, steroids, polysaccharides, alkaloids, amino acids, lipids, sesquiterpene, quinones, and naphtha- lene groups

Advantages- natural properties help nourish the hair follicles, preventing the loss of pigment and delaying the onset of grey hair

It is excellent for an increase in hair growth activity. Hibiscus is naturally enriched with Calcium, Phosphorus, Iron, Vitamin B1, Vitamin C, Riboflavin, and Niacin, which help topromote thicker hair growth and decrease premature graying of hair. This flower is used for controlling dandruff. Hibiscus exhibits antioxidant properties by producing flavonoids such as anthocyanin's and other phenolic compounds. It can be used to rejuvenate the hair by conditioning.

8. Tea –



- Synonyms -Camellia sirens
- Biological Source -Herbal teas are made from mixtures of dried leaves, seeds, grasses, flowers, nuts or other botanical elements
- Graphical source -Asia and Africa with smaller areas in South America and: around the Black and Caspian Seas
- Chemical constituents- Eight catechins, caffeine, theaflavine, gallic acid, chlorogenic acid, ellagic acid, and kaemp
- Advantages The antioxidants in tea soothe the scalp, reducing inflammation and alleviating conditions such as dandruff and scalp irritation. Shine and Luster: Tea rinses impart a natural shine to the hair, making it look healthier and more vibrant.ferol-3-2.

9. Clove



- Synonyms -Eugenia caryophyllata
- Biological source- Cloves consist of dried flower buds of Eugenia caryophyllus
- Graphical source -the flower buds of an evergreen tree that is native to the North Moluccas Islands in Indonesia

• Chemical constituents- Eugenol is the major compound, accounting for at least 50%. The remaining 10–40% consists of eugenyl acetate, β -caryophyllene, and α -humulene.

Advantages- The clove health benefits for hair also include preventing early hair graying, as it helps to improve pigment production responsible for your natural hair color. The antioxidants present in clove oil fight against the oxidizing stress, which leads to premature hair graying.

Clove a spice derived from the flower buds of the Syzygium aromaticum tree, serves as a multifaceted ingredient in herbal hair care. Rich in antioxidants, clove offers numerous benefits for both the scalp and hair. When incorporated into herbal hairy dyes, clove helps stimulate blood circulation in the scalp, promoting hair growth and overall scalp health.



Experimental work

MATERIALS AND METHODS -

The plant use in this study are Indigo, Henna, bhringraj, amla, reetha tea, coffee, waln, clove, soapberry tree.

Preparation of natural hair colorants:-

The Leaves of henna, indigo, tea and bhringraj are dried In shade. They were made into powders and used For preparation for hair colorams.

Collection of unpigmented hair:-

The human hair was collected from barbers shop From which white hairs was separated and used for Studied.

Preliminary preparation of hair colorants:-

One gram of each indigo, Henna, tea, bhringraj was Collected and added to 200 mg of urea in sample. A Smooth paste was made with water separately paste Were kept for aside for 1h for inhibition. The hair was kept in above paste for 1h and then washed With water and observed its coloring.

Selection of suitable combination with Henna :-

One gram of henna is mixed with same proportion Of indigo tea, bhringraj and 20% urea and water is Added in order to make smooth paste. The paste was Kept aside for 1hr inhibition and hair was kept Above paste for 1hr inhibition. After it was washed And observed for colouring. The bean should be covered. It should be left for 2-3 hours on the bean for complete drying. Either it Should be removed by washing with plain water.

• FORMULATION OF HERBAL HAIR DYE

Procedure: - Accurately weigh all the powdered ingredients such as Henna, Amla, Reetha, Shikakai, Hibiscus, Neem, jatamansi, Bhringraj, Tea, Tulsi, Black catechu, lohbhasma, Brahmi, Methi and orange peel powder was mixed together in large paper. For uniform mixing it can be Screened by using sieve no.85.then scab all the powder mixture by using spatula, fill in a suitable Container, store at a 37oC temperature.

Sr. No	Ingredients	Quantity(gram)		
		F1	F2	F3
1	Heena	100	70	80
2	Amala	50	60	70
3	Reetha	20	30	40
4	Shikaki	20	20	20
5	Indigo	50	50	60
6	Hibiscus Powder	40	60	50
7	Tea	20	25	25
8	Clove	2	05	03
9	Coffee	20	20	20

• Evaluation of Herbal Hair Dye -

1. Organoleptic Evaluation - It is a method analyzing herbal dyes by identify their sensory characteristics such as colour, odour, texture and appearance.

Sr.No	Parameters	Result
1	Colour	Brownish Green Colour
2	Odour	Characteristics
3	Texture	Fine
4	Appearance	Powder

2. Physico-chemical Evaluation – The physical and chemical feature of the herbal hair colour to determine the pH, its moisture contain and its ash value for the purpose of stability the volume of inorganic matter present in it. In this evaluation there are three tests include :

Formulation :-

Sr.No.	Parameters	Result		
		F1	F2	F3
1	PH	6.6 Room Temperature	6.5	6.4
2	Loss of drying	2.8	3.5	2.8
3	Ash value	2.5	2.9	3.5

4. Phytochemical Evaluation-

Prepared herbal hair dye was subjected to Phytochemical screening to reveal the presence or Absence of various phytoconstituents as Carbohydrates, Lipids, Alkaloids, Sugars etc. The Formulation when dissolved individually in 5 ml of water and filtered; the filtrates were used to Test the presence of carbohydrates. The aqueous extract of the formulated herbal face pack Was evaluated for the presence or absence of different phytoconstituents as per the standard Procedures and norms. The results of phytochemical screening are highlighted in Table.

A. Stability Test – stability testing is a process that evaluate the quality of cosmetic product such as hair dye overtime. It can help determine the shelf life of product and ensure its safety and quality.

B. Molisch's Test – The material require for this test is herbal hair dye formulations as a sample, distilled water, alpha-napthanol, absolute ethanol, sulphuric acid. Molisch's test is a chemical test used to detect the presence of carbohydrates in a material. The colour intensity of hair dye might change based on the proportion of carbohydrates.

C. Volatile Oil Test – The material required for this test is herbal hair dye formulations as a sample, absolute ethanol distilled water. The volatile oil test is a widely used method for analyzing and identifying essential oils.

Formulation :-

Sr. No	parameter	Result
1	Foam Test	Present
2	Molisch Test	Carbohydrates Present
3	Mayer's Test	Alkaloids Present
4	Volatile oil Test	Volatile Oil Present

Stability Test:-

Formulation :-

Sr. No.	Parameter	Result		
		F1	F2	F3
1	Colour	No change	No change	No change
2	Odour	No change	No change	No change
3	Texture	Fine	Fine	Fine
4	Smoothness	Smooth	Smooth	Smooth

5. Rheological Evaluation-

For the in-house formulation, physical characteristics such as untapped or bulk density, tapped Density, angle of repose, Hausner's ratio, and Carr's index were measured and computed. Bulk Density represents the collective adjustment of particles or granules in packed form. D = M/V is The formula for calculating bulk density (D), where M is the mass of particles and V is the total Volume inhabited by them. A graded cylinder is used to determine this. A funnel was used to add 100 gm of weighed formulation to the cylinder. The original loudness was recorded, and the Sample was then fully tapped. The bulk density value was determined using the original volume And the volume detected after tapping, from which the tapped density was derived. The angle of Repose measures the flow qualities of powder by influencing particle cohesiveness. The fixed Funnel cone method involves calculating the Height (H) above the paper on a level surface. The Pack was gently poured down the funnel until the peak formed. R is the radius of the conical heap, And tan a = H/R or a = arc tan H/R signifies the angle of rest, where 'a' is the angle of repose. Hausner's ratio is related to interparticle friction and affects powder flow characteristics. D/D' is The Hausner's ratio, where D' is the tapped density and D is the bulk density. Carr's index, as Demonstrated in aids in determining powder flow from bulk density.

Sr. No.	Parameters	Result F1	F2	F3
1	Bulk density	0.5 (g/cm ³)	0.7(g/cm ³)	1.5(g/cm ³)
2	Tapped density	1.5(g/cm ³)	1.7(g/cm ³)	2.2(g/cm ³)
3	Angel of repose	41.250	42.260	44.270
4	Carry's index	66%	69%	72%
5	Hausner's ratio	3	4	5

• Conclusion -

A herbal hair dye colours the hair in an almost gentleman. Its helps to treat dandruff by removal of excess oil from scalp. Herbal hair dye colour the hair in combination almost gentle manner. Its nitrifies the skin of the block and hair. This hair utterance provides vital pabulum to the skin. It helps to treat dandruff by jettison of supererogatory canvas from scalp. The herbal hair dye gives the hair very mild shade. The skin receives essential nutrients form the hair mixture by clearing the scalp of extra sebum, it aids the treatment of dandruff. Regular uses of this pack leave colour hair colour free and manageable. Herbal hair dyes offer a compelling alternative to traditional synthetic hair colouring products. Stress, aging, pollution and arid regions all degrade hair quality. The colour obtains from the pack it's close to natural hair black colour.

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