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The Potential of Achyrathes Aspera in Herbal Hair Dye: Formulation and Evaluation

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ABSTRACT

Herbal medications are plant-based materials or products that contain either unprocessed or processed substances from several different plants and have therapeutic or other benefits for humans. Herbal shampoo, herbal pills, herbal hair dye, herbal toothpaste, and other cosmetic formulations are made with herbs. Synthetic hair colors are said to induce skin and other skin-related disorders, in contrast to natural hair dyes. The development and assessment of herbal hair dye by adding *Achyranthes aspera* is the primary goal of the current investigation. *Achyranthes aspera* has many medicinal benefits; the leaf extract of *A. aspera* has antioxidant activity, which was used in the herbal hair dye. It is known as Chirchita and Latjeera in local language. It belongs to amaranthaceous family. Other ingredients were used (Henna, tea, bhringraj etc.) Evaluation of dye performed for organoleptic characteristics, presence of phytoconstituents, loss on drying, ash value etc.

INTRODUCTION

Hair dye formulations contain dye modifiers, alkalizers, antioxidants, ammonia, fragrance, wetting agents, and a number of other compounds used in minute amounts to impart unique attributes to hair, such as softening the feel or giving the dye a desired effect. Colorants can be categorized as temporary or permanent. Temporary coloring allows for easy removal of the color from the hair. Permanent hair coloring entails the addition of aromatic diamines or polycompounds like paraphenylenediamine to the composition. Continuous use of dye-containing substances on natural hair causes a variety of negative effects, including skin irritation, hair loss or damage, skin cancer, and erythrema. Other compounds used in hair colors act as modifiers, stabilizing the dye pigments or altering the tint. Antioxidants prevent the color from oxidizing in contact with air. Sodium sulfite is the most widely used ingredient. For the alteration of pH alkanizing agents are used because dye work better in alkaline form, commonly used alkalizer is ammonium hydroxide. Colorants can be categorized as temporary or permanent. Temporary coloring allows for easy removal of the color from the hair. Permanent hair coloring entails the addition of aromatic diamines or poly compounds like paraphenylenediamine to the composition. Continuous use of dye-containing substances on natural hair causes a variety of negative effects, including skin irritation, hair loss or damage, skin cancer, and erythrema. Other compounds used in hair colors act as modifiers, stabilizing the dye pigments or altering the tint. Antioxidants prevent the color from oxidizing in contact with air. Sodium sulfite is the most widely used ingredient. [1]

A dye is a colored substance that possesses an affinity for the fiber, hair, or fur. It is usually applied as an aqueous solution and may necessitate the use of a mordant treatment to improve the dye's fastness on the fiber, hair, or fur. Natural dyes, also known as mordant dyes, produce a variety of color hues with the same dye. In comparison to natural hair dyes, synthetic hair dyes are reported to cause skin and other skin related diseases. The manufacturing process is hazardous to health of the people involved in the process and its applications leads to environmental pollution and also causes potential side effects to the consumers of the product. The fear of side effects from the synthetic dyes has limited its use by health conscious customers throughout the world and has to overcome various regulatory barriers before it reaches its destination. [2] Today, there is a growing need for safer and more ecologically friendly hair dyes due to increased awareness of the negative impacts of human hair dyes on a global scale. Based on how quickly they wash off, hair color products fall into three categories: semi-permanent, permanent, and temporary. [3]

Millions of people use hair coloring products nowadays, and both men and women use them frequently. Cosmetics used for hair coloring are known as hair dye cosmetics. Although these treatments were first created to help women cover up gray hair, men are starting to use them as well. In fact, there are now a number of hair color solutions available that are specifically made for men. These days, people can use this kind of product for more than just covering up gray hair; they might even use it to radically alter or intensify their original hair color. [4]

ACHYRANTHES ASPERA

It is customary to use *Achyranthes aspera*. Linn, sometimes known as the prickly chaff flower, belongs to the family Amaranthaceae and is used to treat a variety of illnesses. It is antiphlegmatic, diuretic, pungent, purgative, antiperiodic, and beneficial for oedema, piles, etc. Plant infusion is used for

pneumonia, while root infusion acts as a mild astringent for gastrointestinal issues. To treat jaundice, the inflorescence of the plant is boiled in water, sieved, and then taken orally. A paste made from roots dissolved in water is utilized to treat corneal opacities and ophthalmia. Alkaloids, phenols, sterols, and triterpenoid saponins, which include olealonic acid as an aglycone are the main class of phytoconstituents found in plants. The plant has been found to contain an alkaloid called achyranthine, arginine, amino acids, histidine, methionine, isolucine, lucine, phenylalanine, tryptophan, carbohydrates, galactose, rhamnose, glucose, and xylose, a significant amount of potash, hormones, inokosterone, and ecdysterone. The herb possesses abortifacient, antimicrobial, and anti-inflammatory properties. A. aspera has been shown to have antiarthritic, anticancer, and anti-hepatocarcinogenic properties in addition to raising thyroid hormone levels. Additionally, the plant is said to have wound-healing, and antidepressant properties. [5]

Antioxidant activity of *achyranthes aspera*

As a normal biochemical process in cells, oxidation can occasionally lead to the production of free radicals, including ozone, hydrogen peroxide, and hypochlorous acid. [6] *Achyranthes aspera's* antioxidant activity was reported by S. Edwin et al. [7] Kumar Vijaya et al. (2009) and Gayathri et al. (2009) also reflected antioxidant activity on leaves and roots. [8] The antioxidant activity of A. aspera was also reported by Manandhar et al., who validated it using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging experiment. [9]

- Antioxidants enhance blood circulation and nutrient availability to scalp cells, which promotes hair growth.
- They shield the cuticles from sun damage.
- They help alopecia patients grow hair.

MATERIALS AND METHODS

All the plant materials used for study were collected from local area U.S.Nagar. The leaves of the plant *(Achyranthes aspera* -used as an antioxidant) was segregated and washed out properly with distilled water to remove any kind of impurities and dust.

Table1. Ingredients used for preparation of herbal hair dye

Sr.no.	Ingredients	Quantity	Sr.no.	Ingredients	Quantity
1	Henna	25 gm	5	Bhringraj	5gm
2	Amla	12.5 gm	6	Tea	5 gm
3	Reetha	5gm	7	Brahmi	5gm
4	Neem	5 gm	8	Achyranthes aspera	5 gm

Henna

- Scientific name - *Lawsonia inermis L.*
- Family -Lythraceae .

When used properly, henna as a hair dye yields a wide range of tints; when applied incorrectly, however, it can occasionally produce intriguing but unwanted colors. The plant is known by numerous synonyms, including Egyptian privet, cypress bush, and camphire. [10, 11]

Amla

- Scientific name - *Phyllanthus emblica L.*
- Family- Phyllanthaceae.

The Indian medical system makes extensive use of amla fruit, either by itself or in combination with other plants, to cure fever and common colds as well as liver and hair tonics, laxatives and diuretics. Amla is incredibly nutrient-dense and among the best providers of minerals, amino acids, and vitamin C. It improves the coloration and growth of hair. [12]

Reetha

- Scientific name - *Sapindus mukorossi*
- Family - Sapindaceae

Reetha promotes luster, volume, and helps prevent hair loss. Reetha also combats dry scalp and dandruff. Reetha has anti-microbial, anti-bacterial, and anti-fungal qualities that aid in combating against head lice. Reetha is offered in powdered or dried form.

Neem

- Scientific name - *Azadirachta indica*
- Family - Meliaceae

Because of its antibacterial qualities, neem is the greatest treatment for lice, dandruff, and dryness. It encourages hair development and stops hair loss. To treat dry hair and get rid of dandruff issues, use powdered neem, Tulsi, and amla. [13]

Bhringraj

- Scientific name - *Eclipta alba*
- Family - Asteraceae.

Because of its characteristics that promote hair growth and blackening, E. alba is referred to as the "King of Hair." Based on the color of the flowers or fruits, E. alba is divided into three groups: yellow-flowering, white-flowering, and black-fruiting. Every type of it can be found in lakes, rivers, and marshes as well as in the Indian foothills of the Himalayas. [14]

Tea

- Scientific name - *Camellia sinensis*
- Family - Theaceae

Due to its abundance in selenium, polyphenols, copper, melatonin, and phytoestrogen tea has long been utilized as a hair colorant in traditional Chinese and Ayurvedic medicine. [15]

Brahmi

- Scientific name – *Bacopa monnieri*
- Family – Scrophulariaceae

Brahmi is used to cure dandruff and reduce inflammation and hair loss. When applied as a powder in an oil or mask, brahmi can help soothe irritated scalps, enhance hair density and luster, and lessen premature greying and hair loss. [13, 16]

ISOLATION OF LEAF EXTRACT OF ACHYRANTHES ASPERA

- Leaves extract of Achyranthes aspera was isolated by using soxhlet extraction method.
- Leaves was washed and dried at room temperature for about 15 days and then converted into fine powder by using mortar pestle.
- 20 g of Powder is taken and filled in the soxhlet apparatus and in round bottom flask 200 mL of the methanol is taken and set to the assembly. (Temp. About 55^0C)
- 1/3 Methanol was discarded after the complete extraction.
- Then phytochemical analysis of the isolated leaf extract was carried out. [17]

PHYTOCHEMICAL ANALYSIS OF ACHYRANTHES ASPERA

Shinoda test – This test was performed to determine the presence of flavanoids. Alcohol was used to dissolve the sample extract, and then droplets of magnesium turnings were added. Next, drops of strong hydrochloric acid were added. When flavanoids are present, a pink color begins to form.

Mayer's test – This test was performed to find the presence of alkaloids in Sample. A. aspera sample extract was dissolved in diluted hydrochloric acid, filtered, and subjected to treatment with Mayers' reagent. The formation of the yellow, cream, and reddish brown precipitate indicates the existence of alkaloids.

Libermann-Burchard test– This test determine the presence of steroids. Chloroform was used to dissolve the sample extract, and then small amounts of acetic acid and conc. sulfuric acid were added. Steroids were present, as indicated by the deep green color. [9]

Molisch test - A clean test tube was filled with a few drops of the prepared test solution. In the test tube, 2–3 mL of the Molisch reagent were introduced and stirred. Gradually and gradually pour strong sulfuric acid down the test tube's edges to create a coating on top of the mixture. Check the test tube to see if a violet or purple-colored ring appears where the two layers converge. When a violet or purple ring forms, it means that there are carbs in the sample. [16]

Ferric chloride test – This test was used to determine the presence of tannins. 200 mg of the plant extract was taken and boiled with distilled water (10 mL), and 0.1% ferric chloride was added to the above mixture; blue-black color forms indicate the presence of tannins in the sample. [18]

PREPARATION OF HERBAL HAIR DYE

- All the powdered ingredients (Henna, amla, neem, reetha, bhringraj, brahmi, tea and *Achyranthes aspera*) were weighed accurately.
- Powder was triturated in mortar and pestle.
- Then the mixture of powder was scabbed by using a spatula, filled in a container, and labeled.

RESULT

PHYTOCHEMICAL ANALYSIS OF A. ASPERA

Phytochemical test including test for the presence of alkaloids, carbohydrates, steroids, flavanoids, tannins are performed on the leaf extract of *Achyranthes aspera*. The results are shown in the table2.

Table2. Phytochemical evaluation of leaf extract of *Achyrantes aspera.*

Phytochemical tests	**Phytoconstituent**	**Result**
Shinoda test	Flavanoids	+
Mayer's test	Alkaloids	+
Libermann – Burchard test	Steroids	-
Molisch test	Carbohydrates	+
Ferric chloride test	Tannins	-

EVALUATION OF PREPARED HERBAL HAIR DYE

Organoleptic evaluation

Formulated hair dye was evaluated for organoleptic characteristics such as color, odour, texture and appearance.

Table3. Organoleptic evaluation of herbal hair dye.

Parameters	**Result**
Colour	Greenish brown
Texture	Fine
Odour	Characteristics
Appearance	Powder

Physicochemical evaluation

Physicochemical parameters such as pH, loss on drying in dye and ash value were evaluated for the purpose of compatibility, stability and to determine the amount of inorganic matter present in the formulated herbal hair dye.

Table4. Result of physicochemical evaluation of herbal hair dye

Parameters	**Result**
Loss on drying	1.15%
Ash value	5.3%
Ph	6.5

Phytochemical evaluation

Phytochemical evaluation was carried out to find the presence of different phytoconstituents in the herbal hair dye.

Table5. Phytochemical analysis of herbal hair dye

Phytocostituents (Test performed)	**Result**
Alkaloids (Mayer's test)	+
Saponin (Foam test)	+
Carbohydrates (Molisch test)	+
Volatile oil	-
Steroids (Libermann burchard test)	-
Flavanoid (Shinoda test)	+

Patch test

Usually, a little dab of the aqueous solution is used for this. A hair dye solution in an area measuring one square centimeter beneath the ear or on the inner elbow was applied, then left for drying. Swelling, redness, and irritability at regular intervals for up to 24 hours were measured.

Table6. Patch test result of prepared herbal hair dye

Parameters	**Result**
Redness	-
Irritation	-
Swelling	-

DISCUSSION

The formulated herbal hair dye contains many different ingredients that impart many benefits to the hair. Henna is used as a coloring principle in hair dye, which is also a good conditioner for hair and promotes hair growth. Amla is rich in vitamin C. Bhringraj prevents hair loss and also nourishes the hair. Neem has antibacterial properties that can help remove head lice. Reetha powder can help to reduce frizz and make hair follicles stronger. The tea used in the hair dye also offers coloring properties and helps prevent dandruff. Brahmi helps hair look thicker and shinier and also reduces dandruff. All the ingredients used in herbal hair dye offer a number of benefits for the hair. *Achyrantes aspera*, used in the preparation of herbal products, has many medicinal benefits; it acts as an anti-inflammatory and antibacterial agent and is used in bronchial infections, coughs, etc. Apart from this, it also possesses antioxidant activity in its leaf extract, as confirmed by many researchers in their research work. So the antioxidant activity of *Acyrathes aspera* was used in the preparation of herbal hair dye, as antioxidants promote hair growth, prevent immature graying of the hairs, and increase blood circulation, which promotes the growth of new hairs. A phytochemical test of the leaf extract of *A. aspera* was performed to check the presence of the different phytoconstituents, and the results showed the presence of alkaloids, flavonoids, and carbohydrates. Prepared herbal dye was also tested for different parameters, like physicochemical, phytochemical, organoleptic, and skin patch tests.

CONCLUSION

Prepared dye was tested for all the parametes, and it was found to be best used for hair coloring. *Achyranthes aspera* was used in the preparation and was also evaluated for the presence of different phytoconstituents like alkaloids, flavonoids, carbohydrates, tannins, and steroids. The antioxidant potential of *Achyranthes aspera* was used in the herbal dye, which offers benefits to hair such as promoting hair growth and enhancing blood circulation, which is beneficial for new hair growth.

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