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Formulation and Evaluation of Herbal Hair Dyes from Tannin Producing Plants - A Substitute for Chemical Hair Dye

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Abstract: Lots of people infrequently have the urge to change or improve their hair color, but are unwilling to use the harsh and, in some cases, potentially damaging hair dyeing chemicals found in most marketable dyes and color rinses. In comparison to natural hair dyes are described to cause skin and other skin associated diseases. The manufacturing process is hazardous to health of the people involved in the process and its application and also causes potential side effects to the consumers of the products. Hair dyes derived from plants are safe to use. The method for coloring hair by applying an effective amount of herbal hair dye composition with distilled water as an acceptable carrier. The herbal hair dye shows permanent dyeing to the applied regions of human hair without producing any hair damage or hair loss or skin irritation when compared to the synthetic and semisynthetic dyes. A few of the commonly used natural herbals are henna, chamomile, madder, beets, turmeric, walnuts, etc. In present study, tannin producing plants such as Henna (*Lawsonia inermis*), Brinjal (*Solanum melongena*), Pomegranate (*Punica granatum*), Ridge guard (*Luffa acutangula Roxb*) and Raw Banana (*Musa acuminata*) were selected for the production of natural herbal hair dye.

Keywords: Herbal hair dye, *Lawsonia inermis*, *Solanum melongena*, *Punica granatum*, *Luffa acutangula Roxb* and *Musa acuminata*

I. INTRODUCTION

Today most of the human beings are very careful about their beauty and health. Nearly human beings above 50 years struggle with the problem of balding and greying of hair. Greying starts on the skin of head at about 40 years, starting initially from the hair, followed by beard, moustache and finally up to the chest. The age at which greying starts is deeply influenced by heredity. The usage of natural hair dye for dyeing purposed decreased to a huge extent after the discovery of synthetic dyes. Recently, the effect of synthetic pigments to human is becoming major problem, and some of them are recognized as carcinogenic and also creates harmful consequence in environment. Natural dyes have many excellent properties such as no side effect, high safety factor, biodegradable and environment friendly. In comparison to natural hair dyes and synthetic hair dyes are reported to cause skin and other related diseases. (Rashmi *et al.*, 2018).

Many plants like *Lawsonia inermis*, *Nardostachys jatamansi*, *Eclipta alba*, *Juglans regia*, *Pterocarpus indicus*, *Aloe barbadensis*, *Pilocarpus jaborandi*, *Acacia arabica*, *Phyllanthus emblica*, *Terminalia bellirica*, *Cinnamomum zeylanicum*, *Tinospora cordifolia*, *Hibiscus rosasinensis* and *Centella asiatica* are used as many ingredients in hair care preparations mainly for coloring the hair. Natural dyes also turn as mordants because they hold tannins. Natural hair colorants that are currently marketed mainly contain henna along with plant components that need to be used in the paste form. However, such preparations have several drawbacks like prolonged preparation time, disorganized application, poor rinsability, lack of a standard coloring and incomplete color shades. (Laxmi *et al.*, 2019).

The increase in environmental and health risks in the production of dyes and its use throughout world is a major concern. This work was made possible while inspecting the alternative to the synthetic and semi synthetic dyes. Further, this study is focused to a method for coloring hair, by applying an actual amount of the herbal hair dye composition with distilled water as a satisfactory carrier. The herbal hair dye displays permanent dyeing to the applied regions of human hair without producing any hair damage or hair loss or skin irritation when related to the synthetic and semi synthetic dyes (Nilani *et al.*, 2010). The active constituent also avoids the hair from damage produced by photoreaction and pollution. In present study, tannin producing plants such as Henna (*Lawsonia inermis*), Brinjal (*Solanum melongena*), Pomegranate (*Punica granatum*), Ridge guard (*Luffa acutangula Roxb*) and Raw Banana (*Musa acuminata*) were selected for the production of natural herbal hair dye. There are no reports regarding the natural dye obtained from them. So, the present study was attempt on herbal hair dye from tannin producing plants to replace the usage of synthetic dye. The present study emphasis;

- A. To prepare and formulate the herbal dye from tannin producing plants such as Henna (*Lawsonia inermis*), Brinjal (*Solanum melongena*), Pomegranate (*Punica granatum*), Ridge guard (*Luffa acutangular Roxb*) and Raw Banana (*Musa acuminata*)
- B. To evaluate the herbal hair dyes using various parameters such as organoleptic, physio-chemical and phytochemical studies.
- C. To know the sensitivity and stability of the prepared herbal hair dye.

II. MATERIALS AND METHODS

A. Plant Collection

The source of plant materials such as, Henna (*Lawsonia inermis*), Brinjal (*Solanum melongena*), Pomegranate (*Punica granatum*), Raw Banana (*Musa acuminata*), and Ridge Gourd (*Luffa acutangular Roxb*) were collected from Vadakara, Kozhikode district Kerala.

B. Preparation of Plant Extract

The fresh leaves of henna and fruits of Brinjal, Ridge gourd, peel of pomegranate and raw banana are grinded by using blender and make in the form of paste. The ratio of ingredients was taken in 2:1 ratio of Henna and other ingredients respectively for all the experiment tested. Then the appropriate amount of ingredients was mixed uniformly to prepare a homogenous formulation. Appropriate amount of water is added to make a paste.

C. Application of Hair Dye

The above prepared herbal dye paste should be applied on wet hair, forming a paste in water with optimum consistency. The herbal hair dye will be applied in two intervals of time. First one is the application of henna for 2-3 hours and after that next day apply the various combinations of tanning containing plants. It has to be applied on the hair by using a brush. It should be kept for 2-3 hours on the hair for complete drying. Then it is removed by water.

D. Evaluation of the Herbal Hair Dye

The prepared herbal hair dye was evaluated for its various parameters, such as organoleptic, physico-chemical, phytoconstituents, patch test and stability test.

- 1) *Organoleptic Evaluation* (Wallis et al., 2002): Organoleptic characteristics for various sensory characters like color, texture, odour and appearance was studied.
- 2) *Physico-chemical Evaluation* (Rajpal et al., 2002): The physical and chemical features of the herbal hair dye were evaluated to determine the pH for studying the stability, compatibility and the amount of inorganic matter present in the prepared hair dye.
- 3) *Phytochemical Evaluation* (Kokate et al., 2008): Prepared herbal hair dye was subjected to phytochemical analysis for various phytochemical constituents such as Carbohydrate, proteins, glycosides, saponin, terpenoid, tannin, quinone, flavonoid, alkaloid, phenol and steroids.
- 4) *Patch Test* (Mandeep et al., 2011): This usually involves dabbing a small amount of the aqueous solution of hair dye an area of 1sq.cm and leaving it to dry. Small quantities of prepared hair pack were applied to the area for a specific time. Irritancy, redness, and swelling were checked and noticed for regular intervals of time.
- 5) *Stability Test* (Rani et al., 2015): Stability testing of the prepared formulation was performed by storing the herbal formulation at different temperature conditions for the time period of one week. The packed glass vials of formulation were stored at different temperature conditions such as room temperature and 35°C and were evaluated for the physical parameters like color, odour, pH, texture, and smoothness.

III. RESULTS AND DISCUSSION

Loss of colour in hair is due to varied reasons like genetic influence, effect of environmental factors and use of alcoholic preparations. Though synthetic hair dyes are available in various colour and they have the chief disadvantage of producing hypersensitive reactions in some individuals.

In the present study different combination of herbal formulation were compared and tested. In which the herbal formulation with henna (*Lawsonia inermis*), brinjal (*Solanum melongena*), pomegranate (*Punica granatum*), raw banana (*Musa acuminata*), and ridge gourd (*Luffa acutangular Roxb*) combination makes better result as compared to other combinations such as Henna, Brinjal and Raw banana (HBRB) and Henna, Pomegranate and ridge guard (HPR).

The conducted tests give good and effective results. Organoleptic evaluation shows that the herbal formulation has greenish brown colour, characteristic pleasant odour. Fine texture and paste appearance. The result is shown in the Table I).

Table I: Organoleptic Evaluation of Various Herbal Hair Dye

S. No	Parameters	HBRB	HPR	HBPRBR
1	Color	Greenish brown	Greenish brown	Greenish brown
2	Odour	Characteristic	Characteristic	Characteristic
3	Texture	Fine	Fine	Fine
4	Appearance	Paste	Paste	Paste

*HBPR- Henna, Brinjal and Raw Banana; *HPR-Henna, Pomegranate and Ridge Gourd; *HBPRBR-Henna, Brinjal, Pomegranate, Raw Banana and Ridge Gourd

The physical and chemical features of the herbal hair dye were evaluated to determine the pH for studying the stability, compatibility and the amount of inorganic matter present in the prepared hair dye (Table II,)

Table II: Evaluation of pH of Various Herbal Hair Dye

Parameters	HBRB	HPR	HBPRBR
pH	6.4	6.4	6.5

Prepared herbal hair dye was subjected to phytochemical screening such as Carbohydrate, proteins, glycosides, saponin, terpenoid, tannin, quinone, flavonoid, alkaloid, phenol and steroids.

In herbal hair dye HBRB, terpenoids, tannins, flavonoids, quinone and carbohydrate are present. In which tannin and flavonoid content was found to be high. In the combination of HPR dye showed the presence of terpenoids, tannin, phenol, glycosides and carbohydrate. Whereas in the case of HBPRBR reveals the presence of terpenoids, tannin, quinone, flavonoids, phenol, glycosides and carbohydrate. In all the combination tannin content was found to be maximum when compared to other phytochemical constituents. Also, saponin, alkaloids, aminoacids and steroids were totally absent in all the combination of herbal hair dye tested. (Table III)

Table III: Phytochemical Analysis of Various Herbal Hair Dye.

SL:NO	Phytochemical components	HBRB	HPR	HBPRBR
1	Saponin	-	-	-
2	Terpenoids	+	+	+
3	Tannin	+++	+++	+++
4	Quinone	+	-	+
5	Flavonoids	++	-	++
6	Alkaloids	-	-	-
7	Phenol	-	++	++
8	Glycosides	-	+	+
9	Steroids	-	-	-
10	Aminoacid	-	-	-
11	Carbohydrate	+	+	++

- Indicates the absence; + indicate the presence

Patch test reveals that the herbal hair dye prepared from the various plant sources Henna (*Lawsonia inermis*), Brinjal (*Solanum melongena*), Pomegranate (*Punica granatum*), Ridge guard (*Luffa acutangular Roxb*) and Raw Banana (*Musa acuminata*) in various combination. Among the various combination tested all the herbal hair dye gives negative result for Swelling, Redness and Irritation. From the present study, we can conclude the herbal hair dye was safe and good for health. (Table IV)

Table IV: PATCH TEST OF VARIOUS HERBAL HAIR DYE

SI No	Parameters	HBRB	HPR	HBPRBR
1	Swelling	Negative	Negative	Negative
2	Redness	Negative	Negative	Negative
3	Irritation	Negative	Negative	Negative

The stability of the herbal formulation was tested at two different temperature such as room temperature and at temperature 35°C. The test reveals that there is no change in the colour, odour, texture and smoothness of the herbal dye in both the temperature tested. (Table V)

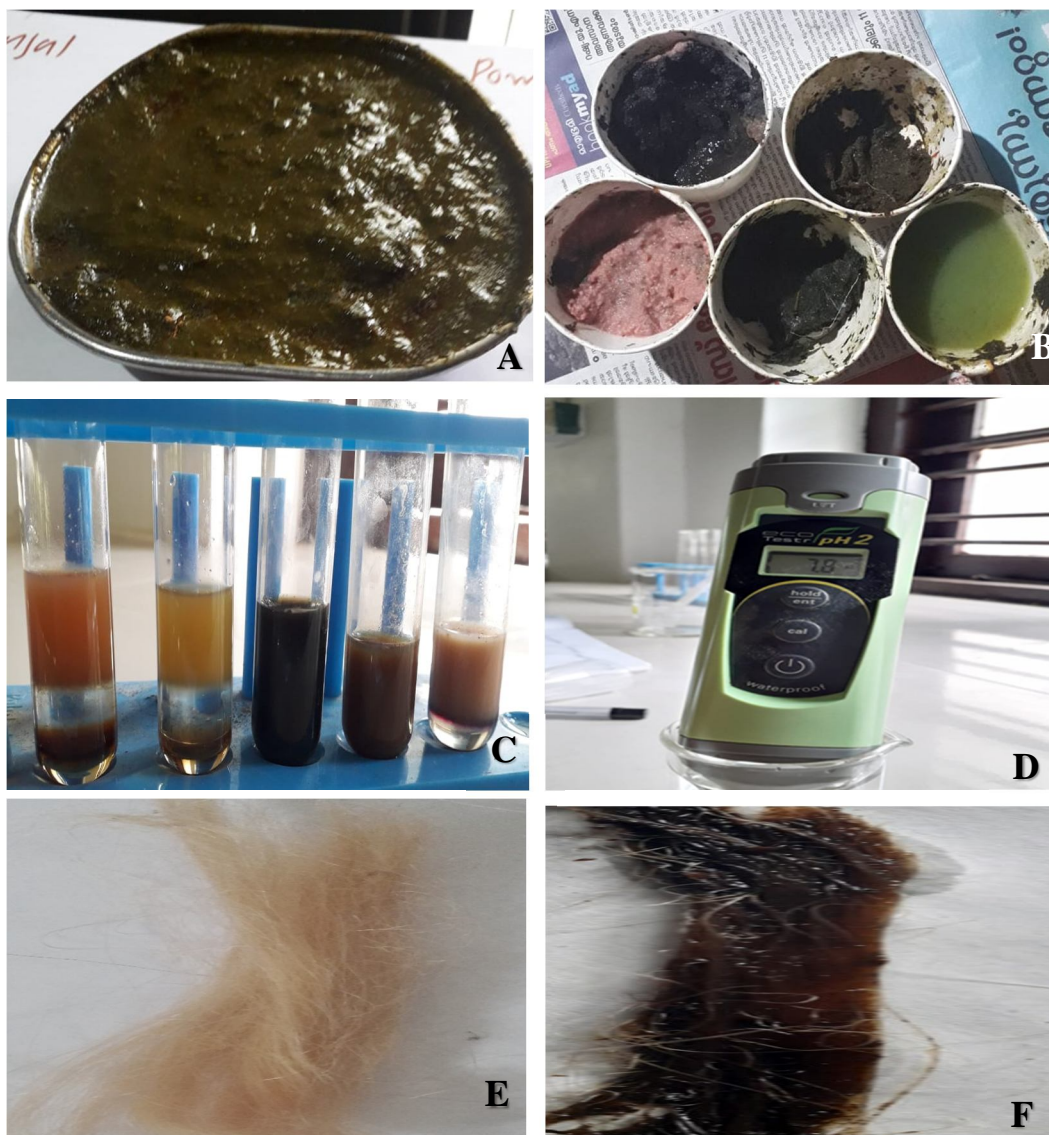
Table V: Stability Test of Herbal Hair Dye

SI No	Parameters	Room temperature	35°C
1	Color	No change	No change
2	Odour	No change	No change
3	pH	6.5	6.4
4	Texture	Fine	Fine
5	Smoothness	Smooth	Smooth

In the present study the plant sources such as Henna (*Lawsonia inermis*), Brinjal (*Solanum melongena*), Pomegranate (*Punica granatum*), Ridge guard (*Luffa acutangular Roxb*) and Raw Banana (*Musa acuminata*) were used for dyeing the hair in combinations of various ratio. The various combination of hair dye tested such as Henna, Pomegranate and ridge guard (HPR), Henna, Brinjal and Raw Banana (HBRB) and all together (HBPRBR). Among the hair dye tested all the ingredient together was found to be best for producing maximum hair colour.

The combination of two or three ingredients such HPR and HBRB was not showed much more result as compared to the combination of all the ingredients (HBPRBR). This may due to the synergetic effect of the herbal compound present in the particular combination. The synergetic effect of some herbs on production of hair dyes was previously reported in hair dye prepared from *Lawsonia inermis*, *Hibiscus rosa-sinensis*, *Murraya koenigii*, *Eclipta alba*, *Punica granatum*, *Emblica officinalis*, *Azadiarachta indica* and *Ocimum sanctum* powders are blended with *aloevera* gel along with iron filing and soaking the mixture to obtain a dye. Also, the natural colour obtained by the herbal hair dye in the present study was may be due to the presence of high content of tannins. Tannins create affinity between dye and hair and thus improve colour and fastness of dye (Rashmi *et al.*, 2015). Organoleptic evaluation of the herbal hair dye result that the hair dye was found to be smooth paste consistency with a pleasant odor. The similar result was obtained by Rashmi *et al.*, (2018) in herbal hair dye plants such as Henna, Amla, Reetha, Shikakai, Coffee, Tea, Hibiscus, Bhringraj and Jatamansi. Physiochemical evaluation of herbal hair dye was performed by determining the pH. The pH of the dye was found to be 6.5, which is an optimum pH for herbal hair dye, was reported by the Rashmi *et al.*, (2018). The phytochemical evaluation was done for alkaloids, flavonoids, carbohydrates, glycosides, proteins and amino acids, phenolic group, saponins, steroids, quinone, terpenoids, tannins and reducing sugars. In which the tannin content was found to be maximum in the prepared hair dye. Tannin plays an important role in the production of colour in dyes. In the patch test reveals no swelling, redness and irritation was found in all herbal hair dye prepared. Thus, the dye can be recommended for persons who have sensitivity to chemical hair dye. Similar result was achieved in the herbal dye preparation from *Lawsonia inermis*, *Hibiscus rosa-sinensis*, *Murraya koenigii*, *Eclipta alba*, *Punica granatum* and *Emblica officinalis* (Rashmi *et al.*, 2018) where herbal hair dye was found to be safe in their patch test.

Vegetable hair dye has numerous benefits that may be beneficial to the hair advantage of this natural hair colorant is that it does not cause any irritation (Ashish *et al.*, 2016). There are so many benefits of using herbal hair dye and also, they are found to be very safe. So, we can recommend the herbal hair dye obtained from the tannin containing plants for the people suffering from graying of hair



A-Paste of the herbs prepared from *Lawsonia inermis*, *Solanum melongena*, *Punica granatum*, *Musa acuminata* and *Luffa acutangular* Roxb, **B-** Hair dye prepared from various ingredients such as *Lawsonia inermis*, *Solanum melongena*, *Punica granatum*, *Musa acuminata* and *Luffa acutangular* Roxb, **C-** Phytochemical analysis on HBPRBR i) Presence of Flavonoids ii) Presence of Terpenoids iii) Presence of Tannin iv) Presence of Carbohydrate v) Presence of Phenol, **D-** Hair fibre before staining, **E-** Hair fibre after staining

IV. CONCLUSION

From the present study we can conclude that herbal hair dye prepared from tannin producing plants showed a good result for colouring the hair. The formulation of this dye is simple and cost effective. That we can prepared from our home itself from our household products. Application and time were quite similar to that of chemical hair dye. So, we can avoid the chemical hair dye that has harmful to human health which leads to some adverse effect such as cancer, skin irritation, hair loss and hair damage. The evaluation of various parameters reveals that the prepared hair dye especially combination (HBPRBR) was found to be optimum for producing hair colouring. There is a high demand for herbal hair dye nowadays, people are moving to herbal products due to its less harmful effect to our health. In the world level herbal hair dye becomes famous and highly advisable so that it makes them commercially important in herbal market. Hence, we recommended the prepared hair dye to our society who suffering from early greying of hair.



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