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Synthesis and Evaluation of Herbal Based Hair Dye

Kishor kumbhar*, Prafulla Tatyasaheb Kulkarni, Vishranti Mohite, Bhagyshree Kamble, Smt. Avani K Shewale
Rajarambapu college of pharmacy, Kasegaon.

Abstract:

Background:

Herbal based hair dyes are being preferred on large scale; due to the vast number of advantages it exerts to overcome the ill-effects of a chemical based hair dye. We have attempted to prepare and standardize this preparation to ensure its quality as well as stability aspects.

Objective:

The current research was aimed at the preparation of herbal hair dye and the evaluation of its various parameters as Organoleptic, physico-chemical, phytoconstituents, rheological aspects, patch test and stability testing for its efficacy and shelf life.

Materials and Methods:

The herbal dye was prepared in-house according to the proposed composition, using all the natural ingredients. The dye was evaluated for its organoleptic, physico-chemical and stability parameters.

Results:

The parameters were found to be comparable and sufficient for the evaluation of herbal dye. The values of different evaluations justified the usage of the hair dye.

Conclusion:

Herbal based hair dye has been prepared and evaluated using the various parameters. It offers a natural alternate, which can be used, irrespective of any side effects. The results can be incorporated while developing the pharmacopoeial standards.

Keywords: Herbal hair dye, Patch test, Organoleptic, Physico- chemical evaluation, Herbal drugs and Chemical hair dye.

INTRODUCTION

As compared to the chemical based hair dyes, which cause skin and other skin related diseases, natural herbal dyes are being preferred nowadays .Today most of the human beings are very careful about their beauty and hairs play an important role in this. Herbal drugs without any adverse effects are used for healthy hair. Nearly 70% of human beings above 50 years struggle with the problem of balding and graying of hair. In few cases, these symptoms of ageing occur earlier. Graying starts on the skin of head at about 40 years, starting initially from the temples, followed by beard, moustache and finally up to the chest. The age at which graying starts is deeply influenced by heredity. But premature depigmentation in adults is mainly due to variety of other factors, as illness, some specific drugs, shock *etc*. People have been using natural dyes since ancient times for

the purpose of dyeing carpets, rugs and clothing's by the use of roots, stems, barks, leaves, berries and flowers of various dye yielding plants. The need of herbal based natural medicines is increasing fastly due to their natural goodness and lack of side effects. Amla, Bhringraj, Henna, Mandara, Jatamansi, Reetha, Sariva, Curry leaves and Methi seeds are well - known ayurvedic herbal drugs traditionally used as hair colorant and for hair growth. Many different extracts from plant were used for the purpose of hair dyeing in Europe and Asia before the invention of modern dyes. Indigo, known as initial fabric dye, could be mixed with henna to make different light brown to black shades of hair dye. Use of these chemicals can result in unpleasant side effects, such as skin irritation, allergy, hair breakage, skin discoloration, unexpected hair color *etc*. Continuous application of such compounds on natural hair causes multiple side effects such as skin irritation, allergy, hair fall, dry scalp, erythrema and also skin cancer. In India, henna has been used traditionally for colouring palms and hairs. There are so many herbs like Kikar, Bihi, Bhringraj, Patnag, Akhrot, Narra, Jaborandi, Jatamansi, Amla, Kuth, Giloe, Behera which are used as a major constituents in hair care preparations mainly meant for dyeing hair. Henna has been used traditionally for colouring women's bodies during marriage and other social celebrations since the times of Bronze Age. It is a part of Islamic and Hindu cultures as a hair coloring and dyeing agent for the purpose of decorating the nails or for the formation of temporary skin tattoos. Drugs from the plant sources are easily available, are less expensive, safe, and efficient and rarely have side effects. In the present era of eco- conservation, the use of natural dyes has been revived and reviewed for the coloration of textiles and food materials.

ROLE OF INGREDIENTS USED IN THE FORMULATION

Henna

its principle coloring ingredient of is lawsone, a red orange colored compound present in dried leaves of the plant in a concentration of 1 1.5% w/w. Lawsone acts as a non oxidizing hair coloring agent at a maximum concentration of 1.5% in the hair dyeing product. Other constituents in henna such as flavonoids and gallic acid act as organic mordants to the process of colouring. Carbohydrates give the henna paste a suitable consistency for adherence to the hair. Natural henna is usually hypoallergenic but allergic reactions occurred in mixed types including black henna. This occurs due to chemical compounds consisting of para-phenylenediamine¸ 2-nitro-4-phenylenediamine¸ 4-aminophenol and 3-aminophenol. Henna has also antifungal activity against Malassezia species (causative organism of dandruff). Henna prevents premature hair fall by balancing the pH of the scalp and graying of hair. Henna leaf paste used for alleviating Jaundice, Skin diseases¸ Smallpox¸ *etc*. Extract of Henna leaves with ethanol (70%) showed significant hypoglycaemic and hypolipidaemic activities in diabetic mice.

Amla

Berries obtained from amla enhances the absorption of calcium, helping to make healthier bones, teeth, nails, and hair. It maintains the hair color and prevents premature graying, strengthens the hair follicles. Amla is the most rich and concentrated form of Vitamin C along with tannins found among the plants.Whole fruit is used as an active ingredient of the hair care preparations. The Vitamin C found in the fruit binds with tannins that protect it from being lost by heat or light. This fruit is also rich in tannins, minerals such as Calcium, Phosphorus, Fe and amino acid. The fruit extract is useful for hair growth and reduce hair loss. Amla has antibacterial and antioxidant properties that can help promote the growth of healthy and lustrous hair.

Reetha

Its fruit is rich in vitamin A, D, E, K, saponin, sugars¸ fatty acids and 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 of hair cleanser. Reetha as soapnuts or washing nuts, play an important role as natural hair care products since older times. This plant is enriched with saponins, which makes the hair healthy, shiny, and lustrous when used on regular basis.

Shikakai

It contains Lupeol, Spinasterol, Lactone, Hexacosanol, Spinasterone, Calyctomine, Racimase-A Oleanolic acid, Lupenone, Betulin, Betulinic acid, Betulonic acid. The extract obtained from its pods is used as a hair cleanser and 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 retains the natural oils of the hair and keeps them lustrous and healthy. It is also effective in strengthening and conditioning hair. Amla, reetha and shikakai compliments each other, therefore, they are mixed together to have healthy and lustrous hair. All of these ingredients come in two forms, one as a dried fruit and other in powdered form. Amla, Reetha and Shikakai suit all hair types and help prevent split ends, hair fall, dandruff, greying of hair and other hair related problems, to make hair soft and silky.

Coffee

In hair colorants, herbs can be used in the form of powder, aqueous extract or their seed oil to impart shades of different colour varying from reddish brown to blackish brown. The herbal drugs like coffee powder obtained from its seeds are used as hair colorants .

Tea

Being rich in polyphenols, selenium, copper, phytoestrogens, melatonin, tea also has been used in traditional Chinese medicine and in Ayurvedic medicine has been used since long as hair colourant .

Hibiscus

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

Bhringraj

Treatment with 5% of petroleum ether extract of bhringraj initiates greater number of hair follicles. The oil based extract of leaves has been used traditionally for improving hair growth and for imparting natural colour to grey hair. Neelibhringaadi Tailam, mentioned in Ayurveda is suitable for promoting hair growth and for providing natural colour to grey hair. Bhringraj is used in the preparation of various oil, shampoo, hair dye *etc*.

Jatamansi

Nardostachys jatamansi is an important drug of Ayurveda and is used in different traditional systems of medicine such as Ayurveda, Unani, Siddha, *etc*. Its rhizomes and roots are used as a tranquilizer, laxative, cardiac tonic, for curing vertigo, nervous headache, low and high blood pressure, *etc*.. The rhizomes as well as roots of the plant are medicinally rich and therefore, have been the focus of chemical studies.

MATERIALS AND METHODS

For the preparation of herbal hair dye, we have selected nine important ingredients such as Henna, Reetha, Coffee, Tea, Shikakai, Amla, Hibiscus, Bhringraj and Jatamansi. Henna leaves and flowers of hibiscus were collected from the herbal garden of PSIT. They were authenticated for their quality in the Pharmacognosy lab of the Institute. Reetha, coffee, tea, shikakai, amla, bhringraj and jatamansi all in the powdered forms were procured from the authorized stores of the local market in the powdered form. Henna leaves and the flowers of Hibiscus were shade dried and coarsely powdered. Then all the ingredients were mixed uniformly to prepare a homogenous formulation. The composition of the formulation is reflected in the Table 1

Table 1. Ingredients of the prepared herbal hair dye.

Sr. No	Ingredient	Quantity
1.	Henna	100 gms
2.	Amla	60 gms
3.	Reetha	20 gms
4.	Shikakai	20 gms
5.	Hibiscus	20 gms
6.	Coffee	20 gms
7.	Jatamansi	20 gms
8.	Bhringraj	20 gms
9.	Tea	20 gms

Application of Hair Dye

The pack, which is in the form of powder, should be used weekly on wet hair, forming a paste of in water with optimum consistency. It should be applied evenly on the hair with the help of a brush, covering the roots to the hair tip. The scalp should be covered. It should be left for 2-3 hours on the scalp for complete drying. Then it should be removed by washing with plain water.

Evaluation of the Herbal Hair Dye

The prepared herbal hair dye was evaluated for its various parameters, such as organoleptic, physico-chemical, phytoconstituents and the rheological aspects.

Organoleptic Evaluation

Organoleptic characteristics for various sensory characters like color, taste, odour *etc*. was carefully noted down. as illustrated in Table 2 The raw drugs and powders were separately studied by organoleptic and morphological characters like colour, odour, texture and appearance.

Table 2. Organoleptic evaluation of herbal dye.

Sr.No	Parameters	Results
1.	Colour	Greenish brown
2.	Odour	Characteristic
3.	Texture	Fine
4.	appearance	Powder

Physico-Chemical Evaluation

The physical and chemical features of the herbal hair dye were evaluated to determine the pH, its moisture content and its ash value for the purpose of stability, compatibility and the amount of inorganic matter present in it. Table 3 reflects the above findings.

Table 3. Physico-chemical evaluation of herbal dye.

Sr.No	Parameter	Results
1.	pH	6.7
2.	L.O.D	1.9%
3.	Ash value	0.19

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 4.

Table 4. Phytochemical evaluation of herbal dye.

Sr.No	Parameter	Results
1.	Foam test	Present
2.	Molisch test	Present
3.	Fehling test	Absent
4.	Hager test	Present
5.	Volatile oil	Absent

Rheological Evaluation

Physical parameters like untapped or bulk density, tapped density, the angle of repose, Hausner's ratio, and carr's index were observed and calculated for the inhouse formulation. Bulk density symbolizes the adjustment of particles or granules collectively in the packed form. The formula for determination of bulk Density (D) is D = M/ V where M is the mass of particles and V the total volume occupied by them. This is determined by taking graduated cylinder. 100 grams of weighed formulation was added to the cylinder with the help of a funnel. The initial volume was noted and the sample was then tapped fully. The bulk density value was obtained from the initial volume and after tapping the volume noticed, from which tapped density was calculated. The angle of repose quantifies the flow properties of powder as it affects cohesion among the different particles. The fixed funnel cone method employs the calculation of Height (H) above the paper that is placed on a flat surface. The pack was carefully poured through the funnel till the formation of the peak. Here, R denotes the radius of the conical heap, tan a = H/R or a = arc tan H/R, where 'a' is the angle of repose. Hausner's ratio is linked with the interparticle friction and influences the powder flow properties. The Hausner's ratio is calculated as D /D' where D' is the tapped density and D, the bulk density. Carr's index helps to measure powder flow from bulk density as shown in Table 5.

Table 5. Rheological evaluation of herbal dye.

Sr.No	Parameters	Results
1.	Bulk density	0.35
2.	Tapped density	0.47 l
3.	Angle of repose	1.04
4.	Carrs index	34.2
5.	Hausners ratio	1.34

Patch Test

This usually involves dabbing a small amount of the aqueous solution of hair dye behind the ear or on inner elbow in an area of 1sq.cm and leaving it to dry. Signs of irritation or feeing of non wellness is noted, if any.Measured and small quantities of prepared hair pack were applied to the specified area for a fixed time. Irritancy, redness, and swelling were checked and noticed for regular intervals up to 24 hours if any. The results of tests for the signs of irritation are displayed in Table 6.

Table 6. Patch test.

S.No	Parameters	Result
1.	Swelling	Negative
2.	Redness	Negative
3.	Irritation	Negative

3.4. Stability Test

Stability testing of the prepared formulation was performed by storing it at different temperature conditions for the time period of one month. The packed glass *vial*s of formulation were stored at different temperature conditions *viz*., room temperature and 35°C and were evaluated for the physical parameters like colour, odour, pH, texture, and smoothness as highlighted in Table 7.

Table 7. Stability test.

Sr.No	Parameters	Room temperature	35^0C
1.	Colour	no change	no change
2.	Odour	no change	no change
3.	pH	6.7	6.8
4.	Texture	fine	fine
5.	Smoothness	smooth	smooth

RESULTS AND DISCUSSIONS

Uses of Hair Dye

The prepared herbal hair dye contains all the goodness of natural ingredients. Apart from acting as a hair dye, this formulation, because of the perfect blend of herbals, also acts as a hair growth promoter, hair nourishes, conditioner and anti-dandruff agent as well. Henna acting as the base

powder, acts as the universal hair dye as it used for its colouring properties throughout the globe. It is also beneficial in the removal of excess oil from the scalp and conditions the hair well. Reetha restores the health of dull, dry, and damaged hair. Bhringraj aids in improving the circulation of blood flow at the root of the hair by providing more nutrients to support hair growth. The extract of Jatamansi is helpful in the growth of hair. It is beneficial for smooth, silky and healthy hair too. Shikakai is packed with vitamins A, C, D and K, which together form a powerful antioxidant. This antioxidant is probably the only thing your hair needs to cleanse the scalp of the sebum buildup, unclog pores, kill infection-causing bacteria and stimulate hair growth. Regular using of hibiscus flower juice can easily restrict hair fall control, dandruff and graying of hair even when you are touching 50 years of age. This is an age-old remedy for all those people who have been struggling for healthy hair that is free from grey hair. It also contains essential fatty acids, which strengthen hair follicles and provides shine and new life. The sufficient amount of vitamin C in Amla helps to halt pre-mature graying. It is a great hair conditioner and also remover of dandruff. Tea imparts perfect colour to the hair in combination with other herbs. It is good for the growth of hair and fights against dandruff. Coffee for hair strengthens hair by improving the overall quality and texture of it. It is absorbed by the follicles, making them softer and shinier, instantly. Organoleptic evaluation findings revealed that the pack is smooth and pleasant smelling powder. Physicochemical parameters reflected that the moisture content was as minimal as 1.9%. pH was found neutral to suit the requirements of different scalp types. Ash value was found to be nominal, signifying the presence of inorganic radicals in appropriate amounts. It shows the presence of major phytoconstituents, which acts as true nourisher for the scalp as well as hair. Irritancy test revealed negative results for irritancy, redness and swelling as the herbals in their natural form without use of artificial additives were found to be compatible with the proteins of hair Stability tests performed at different temperatures over a regular period of one month disclosed the inert nature of the pack in the terms of colour, odour, appearance, texture, and pH. From the above observations, it has been signified that since the formulation is constituted with naturally occurring dried herbal ingredients, there are almost minimal possibilities of the deterioration of the formulation, as there is no moisture containing substance in either raw or processed form. The formulation was kept for one month at room temperature to observe the changes in its color, odour, texture and appearance. The pH was also noticed before and after one month. The formulation was found to be stable. It can be easily stored and used at any temperature, at any place. Since it is a natural herbal based formulation, it is free from the ill-effects of ammonia based chemical dyes. However, the regular use of it provides voluminous, smooth and well coloured hair. Its continuous use shows superb effects later on. Since natural ingredients are known for their non-toxic, non-habit forming properties and no chemicals, preservatives, artificial colors or perfumes has been incorporated in the pack, the chances of its degradation are almost close to the minimal. This leads to an increased shelf life with stable ingredients.

CONCLUSION

A herbal hair pack colours the hair in an utmost gentle manner. The advantages of herbal based cosmetics are their nontoxic nature. It nutrifies the skin of the scalp and hair. This hair formulation provides vital nourishment to the skin. It helps to treat dandruff by removal of excess oil from scalp. Frequent use of this pack leads to manageable, frizz free coloured hair. Pollution, ageing, stress and harsh climates badly affect the quality of hair. In this research, we found effective properties of the herbal hair pack and further studies are needed to be performed to explore more useful benefits of this herbal hair pack. Natural remedies are widely accepted with open hands nowadays as they are safer with minimal side effects as compared to the chemical based products. Herbal formulations are in great demand to fulfill the needs of the growing world market. It is a noticeable attempt to formulate the herbal hair pack containing the goodness of powders of different plants, which are excellent for hair care.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are base of this research.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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