

Formulation and Evaluation of Herbal Hair Dye

Prof. Ugale. S. S., Dr. K. P. Surwase., Mr. Shivaji S. Ghuge

Kishori College of Pharmacy, Beed, Maharashtra, India

Abstract: The medicinal plants are considered to be effective and for most important for the human health. Some of the natural medicinal plants are so common that we use them in daily life without knowing their medicinal important. Custard apple (*Annona squamosa*) is a great natural source of copper and gives hair the dark melanin colour and that it lack. Therefore if you are dealing with too many greys consume custard apple to stop your hair from losing colour further. Hair color change by dye application is a common procedure among women. Hair dye cosmetic products are used for colouring hair.

Hair dye classified according to color resistance, into classified, according to color, resistant, into temporary, semipermanent, and permanent. In oxidation system, there is an intense diffusion of the molecule into the cortex, what promotes a longer color resistance. Dye and color precursors present difference related to chromophore groups...

Keywords: hair dye, temporary, semipermanent, permanent, *Annona squamosa*, Antioxidant

I. INTRODUCTION

Hair colouring or dyeing, practices of changing of the hair color. The main reason for this are cosmetic to recover white and grey hair, to change the regarded as more fashionable or desirable, or to restore the original color after it has been decoloured by hair dressing or sun bleaching. The prepared herbal dye contain all the goodness of natural ingredients. Apart from acting as a hair dye, this formulation, because of the perfect blend of herbal, also act as a hair growth promoter, hair nourisher. [1]

French researchers have found that Egyptians, Greek and Roman were using to dye their hair several thousand years ago. Many different extracts from plant were used for the purpose of hair dyeing in Europe and Asia before the invention of modern dyes. There are three type of hair. [2]

dye. This is temporary, semipermanent, permanent hair color etc. The dyeing of the hair is an ancient art that involves treatment of the hair with various chemicals compound. Hair dye has been used Ancient Egyptian times when Rameses reinforced red hair color using henn. In Ancient Greece, the hair was bleached with a rinse of potassium solution and rubbed with a type of ointment made of yellow flower petals and polle. As compared to the chemical based hair dye, which cause skin and other skin related disease, natural herbal dye are being preferred nowadays. Herbal drugs without any adverse effect are used from healthy hair. The need of herbal based natural medicine is increasing fastly due to their natural goodness and lack of side effects. [3]

Advantage

1. Natural appearance of use of real human hair fibre.
2. Able to color and perm.
3. Moves like natural hair.
4. Less susceptible to heat damage.

Disadvantages

1. More expensive.
2. Need more maintenance and care.
- 3 Requires styling.
3. May be heavier in weight than synthetic wigs, which may be lead to itching.



LITERATURE SURVEY:

1. Bhatia, S.C. (2016)

Title: Perfumes, Soaps, Detergents and Cosmetics

Summary: This book gives a comprehensive overview of cosmetic formulation including shampoos. It highlights surfactants, herbal additives, and natural oils used in cosmetic products. It discusses the benefits of herbal ingredients in reducing side effects and improving hair health. It also explains different evaluation techniques for shampoo. The role of preservatives, pH stabilizers, and fragrances is discussed. It lays the groundwork for formulation understanding.

2. Kumar, D. et al. (2018)

Title: Formulation and evaluation of herbal hair dye

Summary: This study involved preparing herbal shampoo using Reetha, Shikakai, amla, and neem. Evaluation parameters included pH, foam volume, solid content, and conditioning effect. The shampoo was found to be stable and effective in cleansing. The herbal combination showed antifungal and antibacterial properties. Foam stability and mildness were significant. The study proved herbal shampoos can replace chemical ones.

3. Patel, R.P. et al. (2019)

Title: Formulation and evaluation of hair dye containing extract of *Allium cepa* and *Hibiscus rosa-sinensis*

Summary: This paper discusses onion and hibiscus extracts in shampoo for promoting hair growth. The shampoo was evaluated for cleansing action and hair smoothness. The extract combination reduced hair fall. The pH was found to be compatible with scalp. The formulation Kishori College of Pharmacy, Beed Page 9 Formulation and Evaluation of a Phytochemical- Enriched Shampoo for Hair Therapy exhibited excellent lathering properties. The authors emphasize the role of plant phytochemicals.

4. Rao, B.G. et al. (2017)

Title: Formulation and evaluation of hair dye

Summary: Focused on powdered herbal shampoo using dry plant materials. Ingredients included neem, Shikakai, and Reetha. Evaluation included wetting time, foam, and cleansing ability. Herbal powders retained active components longer. The formula was cost-effective. Powder form extended shelf life.

5. Ahmad, I. et al. (2020)

Title: Phytochemical screening and evaluation of hair growth potential of herbal hair dye

Summary: The study screened phytochemicals like flavonoids, tannins, and saponins. The shampoo showed good hair growth potential in in-vivo studies. It had low toxicity. Scalp compatibility was confirmed. Herbal ingredients enhanced circulation and follicle stimulation. They recommended further standardization.

6. Mandal, A. et al. (2015)

Title: Evaluation of cleansing and conditioning effects of herbal hair dye

Summary: Emphasized conditioning agents like aloe vera, amla, and neem. The shampoo improved hair texture and shine. Detangling effect was observed. The herbal base reduced dandruff. Stability studies supported long-term use. Herbal conditioners outperformed synthetic ones.

7. Jain, P. et al. (2018)

Title: Herbal hair dye as natural therapy: A review

Summary: This review compiles various herbs used in shampoos and their roles. Tulsi, brahmi, hibiscus, and neem were discussed. Hair strengthening and dandruff control were common features. The article highlighted safety, biocompatibility, and eco-friendliness. It suggested using locally available herbs. Shampoo formulations need standardization.



8. Sharma, N. et al. (2021)

Title: Pharmacognostic evaluation of some herbs used in herbal hair dye

Summary: Evaluated raw materials used in shampoo formulations. Microscopy and TLC used for identification. Pharmacognostic data helped detect adulteration. Ensured consistency in formulations. Helped in validating raw materials. Important for industrial production.

AIM AND OBJECTIVE

AIM

To Formulate And evaluate a herbal hair dye using medicinal plant extract known for their therapeutic properties with the goal of providing an effective and ecofriendly alternative to synthetic hair dye

OBJECTIVE

1. Natural coloring: Providing a natural alternative to synthetic hair dyes.
2. Chemical-free: Avoiding harsh chemicals that can damage hair or scalp.
3. Nourishment: Many herbal hair dyes contain ingredients that nourish and condition hair.
4. Safety: Reducing the risk of allergic reactions or side effects.
5. Sustainability: Often made from natural, plant-based ingredients, which can be more environmentally friendly.
6. Customization: Offering unique, natural shades and tones.[4]

METHODS OF HAIR DYE PREPARATION

1. Weighing :

Next a worker weigh out of the ingredient for the batch. For some ingredients, only a small amount of is necessary in the batch. But if a very large batch is being made, and several ingredients are needed in large amounts.[6]

2. Mixing :

In a formula in which no pre mixing is required, after checking and weighing, the ingredients are simply mixed together. The ingredients are completely mixed with each other.[6]

3. Filling :

The finished batch of hair dye products formed place in the filling area. Then the measured amount of hair dye on the weighing balance. [6]

4. Packaging :

From the filling area, the plastic bag are taken to the packaging line. The packaging complete and the labelling of the product write the with full information. Then the product are then taken to the warehouse to await distribution. [6]

Role of ingredients used in the formulation :

A. 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 [7,8]. Natural henna is usually hypoallergenic but allergic reactions occurred in mixed types including black henna.



B. 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 [9].

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 [10]. 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 [10].



C. 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 [11].



D. 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 [12].



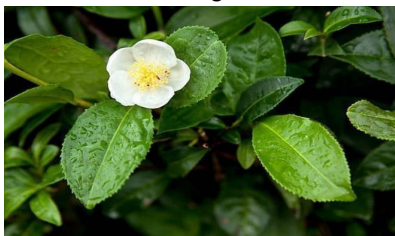
E. Coffee:

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 [13].



F. 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 [14].



G. 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 [15].



H. 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. [16,17].



I. Jatamansi:

Nardostachys jatamansi is an important drug of Ayurveda and is used in different traditional systems of medicine such as Ayurveda, Unani, Siddha, etc. [18]. 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 [18].



6. 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 [19]. The composition of the formulation is reflected in the Table 1.

Table 1. Ingredients of the prepared herbal hair dye.

S. No	Ingredient	Quantity
1.	Henna	10 gms
2.	Amla	6 gms
3.	Reetha	2 gms
4.	Shikakai	2 gms
5.	Hibiscus	2 gms
6.	Coffee	2 gms
7.	Jatamansi	2 gms
8.	Bhringraj	2 gms
9.	Tea	2 gms



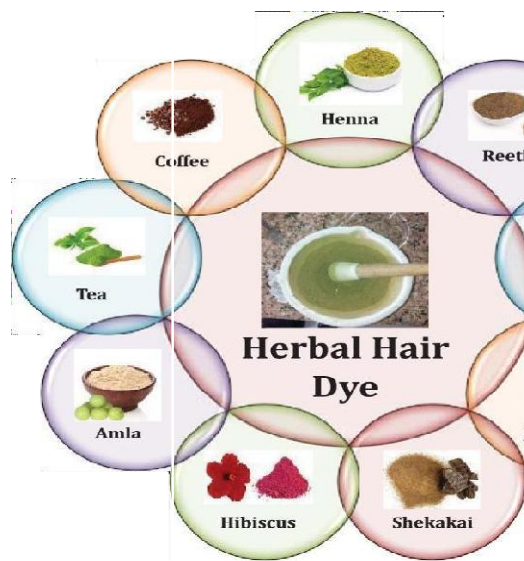


Fig. (1). Ingredients of the herbal hair dye.

TYPES OF HAIR DYES :

Temporary :

1. These type of hair colours used to colour the hair for temporarity.[20]
2. The colorants which are used doesn't penetrate into the hair or surrounding.[20]
3. Can be easily rinsed off water one shampooing.[20]
4. Temporary hair coloring some time used to apply finely ground metals by means of a Puffer Spray.
5. Such metals, which include orasse, bronze and aluminum, both untreated and anodized in various colors, it provide metallic effect when applied to hair, mainly used for high lighting.
6. Powders, setting lotions, crayons are used for temporary color.
7. Temporary hair coloring may also achieved by using yhe leuco derivative of a basic dye like crystal violet.
8. The various type of products used for temporary coloring of hair include rinse, lotion, aerosols, crayons etc.
9. In rinse aqueous or hydro alcoholic solution of simple dye stuffs are used.
10. In lotions dye in solution with a transparent polymer, such as 3% polyvinyl pyrrolidone in water or aqueous alcohol.
11. Crayons are used either directly rubbed on to the wet hair or applied with the help of hair Brus [20].

Semipermanent :

1. Most of them are basic dye stuffis, whose cationic character gives them a natural affinity for the hair. 2.Metalized dye stuffs in combination with nitro derivatives of aromatic diamines or aminophenols.[21]
2. Performance of colorants can be enhanced by the inclusion of solvent.
3. Shampoo is the most commonly used base.[22]
4. Semipermanent dye contains mainly either Nirtophenylene diamines either Nitroaminophenes or either Aminoanthraquinones[22]

Permanent :

1. Most popular hair dye products.
2. The dyes are formed during the dyeing process and are not present, as such in Consists of two parts o Dye intermediate o Oxiding agent
3. Dye intermediates are blends of primary intermediates and coupling agent or modifier, in a suitable base.
4. During dying of hair, the intermediate solutions are mixed and applied to the hair.



5. The primary intermediates are gradually oxidized and then undergo coupling reaction with modifiers. 7. Permanent dye systems are able to dye hair a lighter shade than the original.
8. These dye are capable of confusing the difference in color between individual hair.
9. Very effective on mixed colored white hair and black hair.[23]

Formulation of herbal hair dye :

S. No	Ingredient	Quantity
1.	Henna	10 gms
2.	Amla	6 gms
3.	Reetha	2 gms
4.	Shikakai	2 gms
5.	Hibiscus	2 gms
6.	Coffee	2 gms
7.	Jatamansi	2 gms
8.	Bhringraj	2 gms
9.	Tea	2 gms



EVALUATION OF HERBAL HAIR DYE :

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

Organoleptic evaluation :

Organoleptic characteristics for various sensory characters like colour, odour, taste etc. were carefully noted down as illustrated in Table 1. The raw drugs and powders were separately studied by organoleptic and morphological characters like colour, odour, texture and appearance.[24]

Organoleptic evaluation of herbal hair dye :

S.No.	Parameters	Results
1.	Colour	Greenish brown
2.	Odour	Characteristics
3.	Texture.	Fine
4.	Appearance	Powder



Physio - 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 [25]. Table 2 reflects the above findings.

Physico- chemical evaluation of herbal dye:

S.No.	Parameter	Results
1.	pH	6.5
2.	L. O. D.	1.7 %
3.	Ash value	0.17

Phytochemical evaluation

Prepared herbal hair dye was subjected to Phytochemical screening to reveal the presence or absence of various phytoconstituents as Carbohydrate, Lipids, alkaloids, Sugar etc. The formulation when dissolved individually in 5 ml of water and filtered was used to test the presence of carbohydrates. The aqueous extract of formulated herbal face pack was evaluated for the presence or absence of different phytoconstituents as per standard procedure and norms [26].

The result of Phytochemical screening are highlighted in Table 3.

Phytochemical evaluation of herbal hair dye :

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

Rehological evaluation :

Physical parameter like untapped or bulk density, tapped density, the angle of repose, Hausner ratio and Carr's index were observed and calculated for the inhouse formulation. Bulk density symbolizes the adjustment of particle or granules collectively in the packed form. The formula for the determination of bulk density, (D) $D = M/V$ where M is the mass of the particle and V is the total volume occupied by them. This is determined by taking a graduated cylinder.

Weighing the 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 was 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 cone funnel method employs the calculation of height (H) above the paper that is placed on a flat surface. The powder was carefully poured through the funnel till the formation of the peak [27]. Here R denotes radius of the conical heap. $\tan \alpha = H/R$



/R where α is angle of repose. Hauseners ratio is linked with the interparticle friction and influences the powder flow properties. The Hauseners ratio is calculated as D_t/D_b where D_t is the tapped density and D_b is the bulk density. Carrs index help to measure powder flow from the bulk density as shown in Table 4.

S.No.	Parameters	Results
1.	Bulk density	0.33
2.	Tapped density	0.461
3.	Angle of repose	1.03
4.	Carrs index	34.1
5.	Hauseners ratio	1.32

Rheological evaluation of herbal dye:

Patch test

This usually involve dabbing the small amount of aqueous solution of hair dye behind the ear on or inner elbow in an area 1sq.cm and leaving it to dry. The sign of irritation or feeling of non wellness is noted, if any. Measured and small quantities of the prepared hair pack was applied to the specific area for the fixed time.

Irritancy. redness and swelling were checked and notice for regular interval up to 24 hours if any. The result of tests for the sign of irritation are displaced in Table [28].

Patch test:

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

Stability test

Stability testing for the prepared formulation was performed by storing at different temperature condition for the time of period of one month. The packed glass vials of formulation were stored at different temperature condition for the physical parameters like colour, odour, pH, texture and smoothness as highlighted in Table 6 [29].



Stability testing :

S. No.	Parameters	Room Temperature	35 °C
1.	Colour	No change	No change
2.	Odor	No change	No change
3.	pH	6.5	6.7
4.	Texture	Fine	Fine
5.	Smoothness	Smooth	Smooth

RESULT:

The prepared herbal hair dye contains all the goodness of natural ingredients. Shikakai is packed with vitamin A, C, D and K, which together form a powerful antioxidant. This antioxidant is probably the only thing your hair needs to cleans the scalp of the sebum buildup unclog pores, and hair growth. Coffee for hair strengthens hair by improving the overall quality and texture of it. Hibiscus is excellent for hair growth activity. Custard apple pulp powder is help with premature greying of hair.

Custard apple is a great natural source of copper and gives hair the dark melanin colour. Organoleptic evaluation finding revealed that the pack is smooth and pleasant smelling powder. Phytoconstituents, which acts as true nourisher for the scalp as well as hair. The protein of hair stability tests performed at different temperature. The formulation was found to be stable.

II. CONCLUSION

Herbal based hair dye has been prepared. It offers a natural alternate, which can be used. A herbal hair pack colour the hair in a almost gentale manner. The advantage of herbal based cosmetics are their non toxic nature. It helps to treat dandruff by removal of excess oil from scalp.

The herbal formulation hair pack containing the goodness of powder of different plants, which excellent for hair care. Natural remedies are widely accepted with open hands nowadays as they are safer with minimal side effects as compared to the chemical based products. In this research we found effective properties of the herbal hair pack and further studies are needed to the preformed to explore more useful benifits of this herbal hair pack.

REFERENCES

1. Natural colorants and dye In: Pharmacognosy and phytochemistry. 1st Ed. India: Career publication 2004; 1: pp. 98-117.
2. Kumar S, Akhila A, Naqvi AA, Farooqi AH, Singh AK, Uniyal GC, et al. Medicinal plants in skin care. Lucknow, India: CIMAP 1994; pp. 425-30.
3. Orfanos CE, Happle R. Hair and hair diseases. Germany: Spring-veriang berlin heidelberg 1990; pp. 19-44. [http://dx.doi.org/10.1007/978-3-642-74612-3]
4. Gulrajani ML. Natural dyes and their applications to textiles. India: IIT New Delhi 1992; pp. 1-2.
5. Ashok D, Vaidya B, Devasagayam T. Current status of herbal drugs in India: An overview. J Clin Biochem Nutr 2007; 41(1): 1-11.
6. Khare CP. Indian herbal remedies: Rational western therapy, ayurvedic, and other traditional usage. Botany Springer 2003; p. 89.
7. Brown K. Hair colourants. J Soc Cosmet Chem 1982; 33: 375-83.



8. Madhusudan RY, Sujatha P. Formulation and evaluation of commonly used natural hair colorants. *Nat Prod Rad* 2008; 7(1): 45-8.
9. Mielke H. Lead-based hair products: Too hazardous for household use. *J Am Pharm Assoc* 1997. [http://dx.doi.org/10.1016/S1086-5802(16)30183-8]
10. Balsam MS. *Edward sagarin, cosmetics science and technology*. John Wiley & Sons 1972.
11. Koutros S, Silverman DT, Baris D, et al. Hair dye use and risk of bladder cancer in the New England bladder cancer study. *Int J Cancer* 2011; 129(12): 2894-904. [http://dx.doi.org/10.1002/ijc.26245] [PMID: 21678399]
12. Kalia AN. *Text book of industrial pharmacognosy*. New Delhi: CBS Publishers 2005; p. 264.
13. Kumar S, Akhila A, Naqvi AA, Forooqi AHA, Singh AK, Singh D. *Medicinal plants in skin care*. Lucknow: CIMAP 1994; pp. 51-62.
14. Baran R, Maibach HI. *Cosmetic dermatology in children Text book of cosmetic dermatology*. 2nd ed. London: CRC Press 1998; pp. 507-8.
15. Nadkarni KM. *Indian materia medica*. Popular Prakashan 1976; pp. 630-, 680, 1202.
16. Al-Suwaidi A, Ahmed H. Determination of para-phenylenediamine (PPD) in henna in the United Arab Emirates. *Int J Environ Res Public Health* 2010; 7(4): 1681-93. [http://dx.doi.org/10.3390/ijerph7041681] [PMID: 20617053]
17. Polat M, Dikilitaş M, Oztas P, Alli N. Allergic contact dermatitis to pure henna. *Dermatol Online J* 2009; 15(1): 15. [PMID: 19281720]
18. Kumar KS, Begum A, Shashidhar B, et al. Formulation and evaluation of 100% herbal hair dye. *International Journal of Advanced Research In Medical & Pharmaceutical Sciences* 2016; (2):
19. Mac Dougall Color in food woodhead publishing Ltd 1st Ed.. 2002.
20. Ali NF, El-Mohamedy RSR. Eco-friendly and protective natural dye from red prickly pear (*Opuntia lasiacantha* Pfeiffer) plant. *J Saudi Chem Soc* 2010; 15: 257-61. [http://dx.doi.org/10.1016/j.jscs.2010.10.001]
21. Patel MM, Solanki BR, Gurav NC, Patel PH, Verma SS. Method development for Lawsone estimation in Trichup herbal hair powder by highperformance thin layer chromatography. *J Adv Pharm Technol Res* 2013; 4(3): 160-5. [http://dx.doi.org/10.4103/2231-4040.116780] [PMID: 24083204]
22. S.G. DESIGN AND EVALUTION OF HERBAL HAIR OIL FORMULATIONS BY USING ETHANOLIC EXTRACT OF *Ziziphus jujuba* Mill. LEAVES *Int J Pharma Bio Sci* 2017; 8(3): 322-7.
23. Saif FA. Henna beyond skin arts: Literatures review. *J Pak Assoc Dermatol* 2016; 26(1): 58- 65.
24. Grabley S, Thiericke R. Bioactive agents from natural sources: Trends in discovery and application. *Adv Biochem Eng Biotechnol* 1999; 64: 101-54. [http://dx.doi.org/10.1007/3-540-49811-7_4] [PMID: 9933977]
25. Chaudhary G., *Lawsonia inermis* Linnaeus: A phytopharmacological review. *Int J Pharm Sci Drug Res* 2013; 2(2): 91-8.
26. Singh E, Sharma S, Pareek A, Dwivedi J, Yadav S, Sharma S. Phytochemistry, traditional uses and cancer chemopreventive activity of amla (*Phyllanthus emblica*): The sustainer. *J Appl Pharm Sci* 2011; 2: 176-83.
27. Nisha P, Singhal RS, Pandit AB. A study on degradation kinetics of ascorbic acid in amla (*Phyllanthus emblica* L.) during cooking. *Int J Food Sci Nutr* 2004; 55(5): 415-22. [http://dx.doi.org/10.1080/09637480412331321823] [PMID: 15545050]
28. Gopalan C, Sastri BV, Balasubramaniam SC. *Nutritive value of indian foods*. Hyderabad, India: NIN 1991.
29. Dahanukar S, Thatte U. *Ayurveda Revisited*. 3rd ed. Mumbai: Popular Prakashan 2000.

