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FORMULATION AND EVALUATION OF HERBAL HAIR DYE USING HENNA

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1. INTRODUCTION

Hair dye is important cosmetic item for not only women but also for men. Synthetic dye-basedhair dye or permanent hair dyes consist of two component-colour and developer. Most of them are powerful irritants and have been implicated powerful irritates in several type of allergies and othertherapeutic problems. Other irritant ingredients include H_2O_2 and naphthol. Hair dye solid in Europe union containing any of the ingredient need to carry a warning can cause an allergic reaction containing an ingredient that can penetrate your skin has been determined to cause cancer.If we use permanent or semi-permanent hair color dye and hair dye shampoo continuously we areincreasing the risk of developing breast cancer. Prolonged uses of the hair dye generally cause a local irritation and skin toxicity problems. The use of hair colour is not new. The art of hair dyeing was used by Egyptians from vegetables dyes from the early 5000 years BC. The first artificial dye was synthesized in 1856, and permanent hair colorants have been used commercially for over 100 years. Henna was the most popular and is still one of the popular dyes. But instead of getting black color, red to copper red color was obtained. Loss of natural hair color is due to varied reason like genetic influence, effect of environmental factors. Though permanent synthetic hair dyes are available in varied color ranges, they have the disadvantage of producing hypersensitive reactions also studies have shown permanent hair colour have produced cancer.[5]

A need was felt to formulate a product which is safe for use and does not have any problem of hypersensitive reaction. in the present investigation the formulation is developed to get natural black color using combination of natural products. The main aim of this investigation is to formulate natural and safe hair color. As compared to the chemical-based hair dyes, which cause skin related diseases, natural herbal dyes are being preferred nowadays. Today most of the humanbeings 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 greying of hair. Natural hair dyes solve the problem of hair cuticle, irritation, scalp hair damaging, which are safe for use and does not have the problems of staining skin, itching and hyper sensitive reaction. The natural brown hair dye possesses full penetration to be used as coloring agent and safe hair colorant.[1]

Henna based brown hair dyes that impart natural color to the hair and spreads evenly across the scalp of hair and leave behinds fragrant soft and manageable hair. A systematic scientific approachtoward the active constituent of natural dyes can prevent the hair damage caused by photo- oxidation reaction. So, need was felt to design and formulate natural dyes with commonly implied natural hulls and herbs to be an alternative source to the synthetic and semi-synthetic dyes. In the present investigation three formulations were developed to get natural shades by using combination of natural ingredient. The need of herbal based natural medicines is increasing fast 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. Use of this chemical can be result in unpleasant side effects such as skin irritation, allergy, hair breakage, skin discolouration, unexpected hair colour.[2]

The use of cosmetics in order to change hair colour hair colour, such as hair dye products, occurswith high frequency, mostly among the female population. However, these hair dyes, due to their action mechanisms, may cause serious damage to the hair fibre structure. Throughout human history, many people have wished to change the appearance of their hair because it was a way to differentiate the social status hair dye has been used since ancient Egyptian times when Rameses II reinforce red hair colour using Henna. The ancient Greece,

the hair was bleached with the rinse of potassium solution and rubbed with type of ointment made of yellow flowers petals and pollens. Nowadays, hair dyes are in an important phase of development and since the second world war, great progress in discoveries and application of new synthetic dye has occurred.[6]

Since the conventional methods of hair colouring by the use of natural and synthetic colorants haslimitations. It is an attempt has been made in the study to formulate a gel for hair dye using herbal extracts and other additives from plant source having good colouring properties that is safe and ready to use.[9]

This hair dye is helpful in hair damage, hair fall, scalp problem and maintains integrity of hairs theingredients use in hair dye guava stimulate the proper blood flow to scalp and the follicles and boost melanin production. Amla or Indian gooseberry strengthens the hair roots and promotes hair growth. The Fenugreek treats a variety of scalps issues like dryness of hair, baldness and hair thinning.

Through greying of hair is natural phenomenon associated with ageing there has been a significant occurrence of premature greying specially in women, attributable probably to stress and use of synthetic shampoos. The loss of colouring hair is due to varied reasons like genetic influence, effects of environmental factors use of alcoholic preparations. Greying of hairs results from an absence of pigments, it occurred to the scientists that hydrogen peroxide and catalyst might play a critical role in the process. Every hair cell makes a little hydrogen peroxide, but overtime the amount builds up. The European team discovered that this build up ended up blocking the normal synthesis of melanin, the natural pigment in hair turns out, bleaches itself from the inside out. And by identifying the chemicals involved, researchers may be closer to understand that greying is influenced by stress. Grey hair at early age encourages frequent use of synthetic dyes to colour thegrey patches of hair.[11]

The first artificial dye was synthesized in the laboratory in 1856, and permanent hair colorantshave been in commercial use for over 100 years. Hair dyes can be divided into five categories, each with a specific composition and action mechanism: gradual hair colouring (using metallic dyes such as salts of lead, bismuth or silver), vegetable hair dyes (such as henna), temporary dyes(water soluble dyes that withstand only one-time shampooing), semi-permanent dyes (which can be withstand 4-5 times of shampoo) and permanent hair colours.[5]

Permanent hair colour are the most popular hair dye products. They may be further divided into oxidation hair dyes and progressive hair dyes. Oxidation hair dye products consists of a solution of dye intermediates, e.g. p-phenylenediamine which for hair dyes on chemical reaction, and perform dyes, e.g. 2-nitro-p-phenylenediamine, which already are dyes and added to achieve the intended shades in an aqueous, ammoniacal vehicle containing soap, detergents and conditioning agents; and solution of hydrogen peroxide, usually 6%, in water or a cream lotion.[5]

The ammoniacal dye solution and hydrogen peroxide solution, often called the developer, are mixed shortly before application to the hair. The applied mixture causes the hair to swell and the dye intermediates (and performed dyes) penetrate the hair shaft to some extend before they have fully reacted with each other and form the hair dye. It is common knowledge that many of these synthetic dyes can induced dermatitis and other related problems.

This has prompted us to search for herbal dyeing material of plant origin as alternatives. An attempt here has been made to review the use and suitability of these herbal products to replace the synthetic hair dyes. Continuous use of such compounds on hair hairs causes multiple side effects such as skin irritation, erythema, loss or damage of hair and also skin cancer. The disadvantages of chemically derived dyes can only be overcome by non-toxic ingredients derived from herbal sources. Composition of herbal dyes and hair colouring mordants can be used to deliver variety of colours to hairs. However substantial improvement is needed in the areas of colour saturation, colour development, initial colour consistency improved wash fastness, improve hair conditioning without causing hair damage and skin irritation.[10]

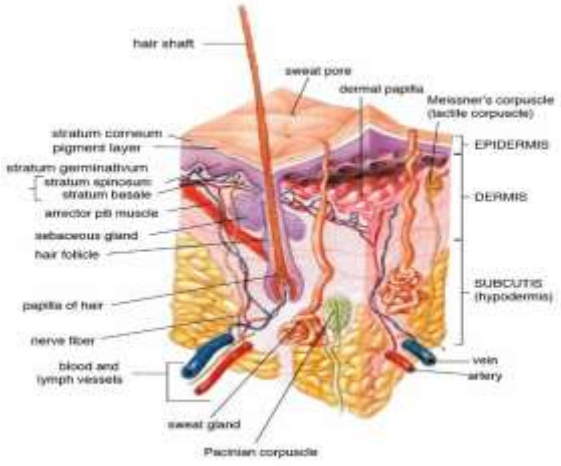

Figure No.1 Structure of Hair Follicle.

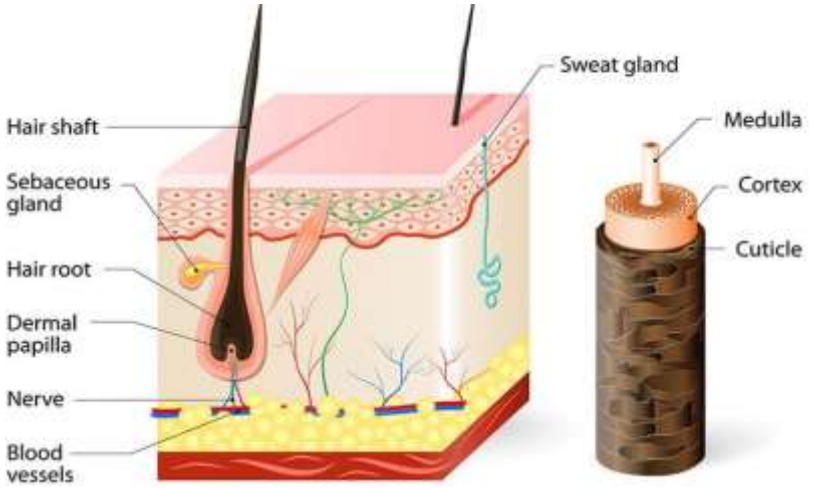

Figure No.2: Anatomy of Hair Follicle.

Table No. 1: Terminologies.

TERMS	DEFINITION
CutaneousMembrane	A stratified epithelial membrane resting onthe top of connective tissue. Type of tissue: Epithelial. Function: cover surfaces, provides a protective barrier. Location: Skin
Mucous Membrane	A composite of connective and epithelial tissues, moist membrane that aid in absorption and secretion. Type of tissue: Epithelial. Function: cover surfaces, provides a protective barrier, provides a lubricating layer, absorption, secretion. Location: Line all body cavities open tooutside (respiratory, urinary, digestive, reproductive.)
Serous Membrane	A membrane made out of epithelial tissue and supported by connective tissue that lines all body cavities closed off to the outside. Made out of 2 layers. Parietal layer-cover the wall closest to the outside of the body. Visceral layer-layer closest to the organs of the body. Type of tissue; epithelial. Function: cover surfaces, provide protectivebarrier, provide a lubricating layer, providean anchor sight to the organs of the body andlubrication lining to prevent friction. Location: all body cavities closed off to theoutside.
Parietal layer	Layer off the serous membrane that coversthe wall closest to the outside of the body.
Viscerallayer	Layer of the serous membrane that is closestto the organ of the body.
Serousfluid	Reduces friction in between the two layers of the serous membrane (visceral andparietal layers)
Synovial membrane	Made of dense fibrous connective tissue thatlines joints. Type of tissue: Connective Function: covers surfaces, provide a protective barrier, cushions, lubricates toprovide supportive movement

	Location: lines the joints.
Integument	"Covering"
Epidermis	Top most protective layer in the integumentary system Location: top most layer (integumentary system). Properties: Avascular: doesn't have blood; 4-5 layers, has keratin (hair and nails), melanin.
Cyte	Cell[7]

1.1 Hair Structure

The hair is made up of 95% keratin, a fibrous, helicoidal protein (shaped like a helix) that forms part of the skin and all its appendages (body hair, nails, etc). Keratin is synthesized by keratinocytes and is insoluble in water, thus ensuring impermeability and protection for the hair. Some 18 amino acids can be found in the hair, such as proline, threonine, leucine and arginine. Keratin is particularly rich in cysteine (a type of sulfurated amino acid), which forms di-sulfide bonds between molecules, adding rigidity and resistance to the entire structure. The hair's structurecan be divided into three distinct parts

A) Medulla: innermost layer of the hair shaft, compose of an amorphous soft, oily substance

B) Cuticle: Thin protective outer layer that contains the nourishing portion essential to hair growth. It is highly keratinized, composed of cells shape like scales that are layered one over the other, measuring about 60 micrometers long and about 6 micrometers wide.

C) Cortex: Main component of hair, containing long keratin chains that add elasticity, and resistanceto the hair. The cells of the cortex are joining together by an intercellular cement reach in the lipidsand proteins. Each cell is composed of bundles that lie in the direction of the hair length: these are macrofibrils which are made of microfibrils, which in turn contain protofibrils.[8]

1.2 Mechanism of hair dyeing

a) By chemical Dye

Most of the chemical dye contain bleaching agent such as ammonia and/or peroxide which damage the outermost layer and create capillaries in hair shaft. Then PPD, OPD, MPD like chemical color fills these capillaries, enter in the inner layer and remain stuck inside, as permanent color. The nextapplication again does the same on hair shaft. This result in loss of strength, roughness and permanent damage to hair.[3]

b) By Natural Dye

Natural Dye colors hair by coating the hair shaft. It provides thickness to hair and stick as a semi-permanent color. The next application again does the same and results in increase in

strength andshine in your hair.

1.3 Types of Hair Dyes

a) Temporary Non-Oxidation Hair Dyeing

These dyes, that present acid characteristics usually have high molar mass. They contain anionic characteristics and are selected to allow the maximum solubility in water and the minimum penetration in hair so it is removed in the first washing. They are presented as shampoo, gel, emulsion and solution (liquid) with two different forms of application: continuous application (progressive) or single application, with one wash at end of the end the application process to remove the unabsorb dye excess on the hair strand. The temporary non-oxidative formulations assingle applications, present higher dye concentrations, ranging from 0.1 % to 2.0 % (w/w) and have the purpose of promoting a stronger dyeing effect. However, the limit of deposition must bealways respected because these types of application will not cover grey hair satisfactorily in peoplewith more than 30% of white hair fibres. The formulation must get in contact with hair for about 30 min and results will occur immediately. It is suitable for those who wish for fantasy colors. It resists from 3 to 6 washes when applied to bleached hair, like semi-permanent dyeing. Examples. of Temporary Non-Oxidation Hair Dyeing are Acid Yellow 1, Acid Red 33, Acid Violet 43 etc.[13]

b) Semi-permanent on oxidative Hair dye

These formulations contain basic or cationic dyes with low molar mass, which has a high affinityfor hair keratin and resists from three to six washes. The hair dyeing process does not involve oxidation reaction; the application is simple and lasts from 10 to 40 min, followed by rising. Several products are available in the market: lotions, shampoos, mousses and emulsions. These cosmetic forms must have the ideal viscosity so the ideal viscosity so that they do not flow duringthe application. Dyes with low molar mass penetrate slightly in the cortex, especially because of the high pH value of the product that promotes the cuticles opening. Another option of formulationinvolves mixing nitro aniline dyes with basic or acid dyes which aim for a better color result and bigger resistance to washes, considering the high affinity of the two families of dyes. The hair space not filled with the basic dyes will be occupied by nitro anilines, thus promoting a much more uniform color in the first application.[14]

c) Pemanent oxidative hair Dyeing

The permanent hair dyes are commonly used because this category provide greater efficacy

of permanent dyeing, resistance to shampoo washes and other external factors, such as dying, friction, light, and others. This category about 80 % of the sold hair dyes and get any shade, covering up to 100 % of white hair strands. Also, it is possible to have dark and light natural hair colour due to the combination of the oxidizing agents with the ammonia hydroxide. The principle difference between the demi permanent hair dye in comparison with permanent one is the alkalizing agent used because, in the first, monoethanolamine with low colour lightening power is used.[15]

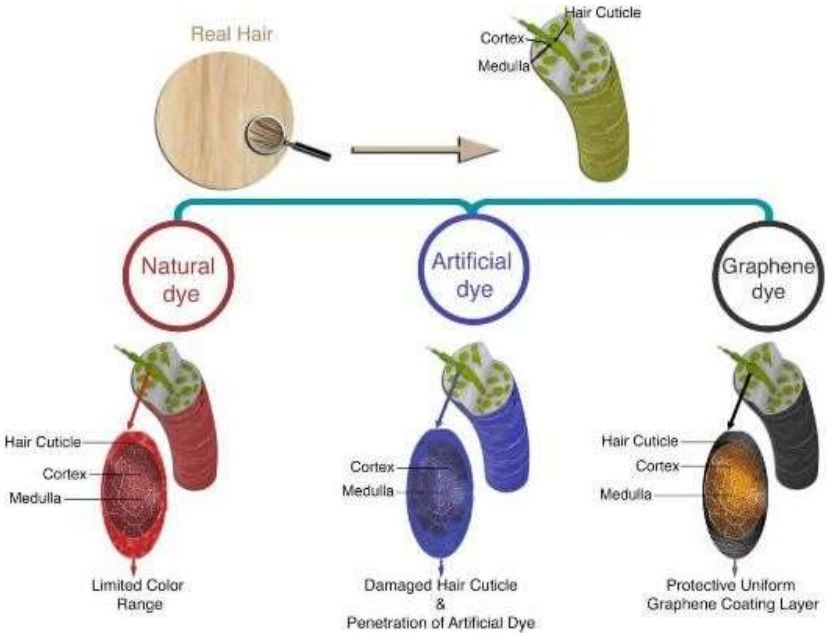

Figure No.3. Graphical Representation of Hair Structure and Various Hair-Dyeing Strategies along with Their Advantages and Disadvantages.

1.4 Natural hair pigmentation

Melanin is a natural pigment polymer, which contributes to human skin colour and influences the degree of hair pigmentation of the two types of melanin found in human hair follicles, eumelanin produces a blackish-brown colour while pheomelanin produces a reddish-brown colour. The ratio of these two types of melanin. Melanocytes are the cells in the body that produce melanin. For every melanocyte there are five keratinocytes in the hair bulb that form a hair follicle melanin. Hair pigmentation activity changes throughout the hair growth cycles (i.e. anagen, catagen, and telogen). During anagen, the growth phase, melanogenesis is active. Melanogenesis halts in the catagen (transition) and telogen (resting) phases.in contribute to different color variations.

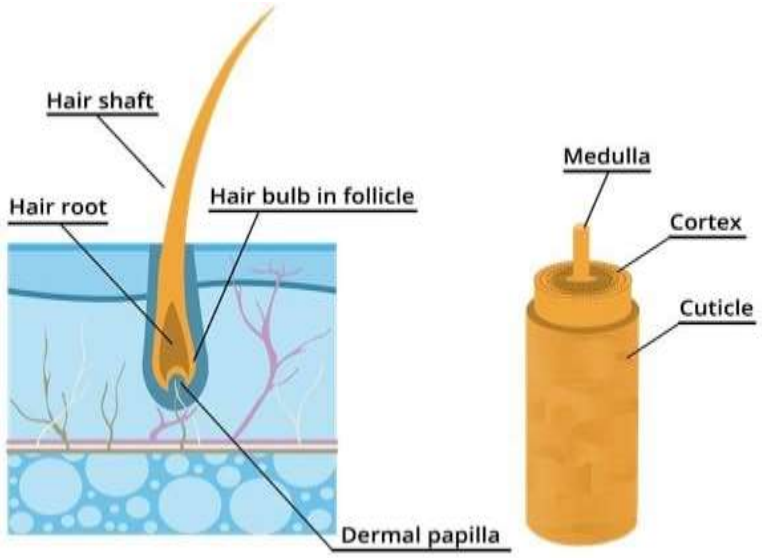

Figure No.4: Hair follicle anatomy.

The two most common types of hair dyes are

1. **Permanent dyes 2.Demi-permanent dyes**

1. **Permanent dyes**

Permanent dyes penetrate and deposit within the cortex, whereas demi-permanent dyes coat the cuticle and eventually fade with subsequent washes. The pH of a dye determines its penetration capabilities.4,5 Alkalizing agents, such as ammonia or ethanolamine, help the pigment to infiltrate the cuticle to reach the cortex.4,5 These agents damage the cuticle's structural integrity overtime and may result in dry brittle hair.

2. **Demi-permanent dyes**

Demi-permanent hair dyes are less damaging than permanent hair dyes since they do not contain ammonia or ethanolamine, and do not penetrate and cause damage to the cortex as they only clingto the hair cuticle. However, like permanent dyes, they do contain hydrogen peroxide (at lower concentrations), resorcinol, and para-dyes. Since these dyes only accumulate on the cuticle, they are not as effective for dying grey or white hair and will not lighten the hair color. These dyes aremore effective for achieving a darker pigment because there is less hydrogen peroxide or bleach needed to achieve lighter hair colors. Demi-permanent hair color pigmentation may fade after 10-15 washes.

2. AIM AND OBJECTIVE OF STUDY

Aim: The present work is based on preparation and evaluation of henna based herbal dye. Thiswork also ensures to;

Objective

- To carry out comprehensive literature survey and selection of crude drugs.
- To study the plant profile of different plants.
- To prepare herbal hair dye and evaluation of its various parameters such as organoleptic, physio-chemical, and phytoconstituents.
- To study the adverse effect of chemical based hair dyes.
- To study how different colours are produced.
- To make herbal based hair dye as an alternative for high cost synthetic dyes.
- To spread awareness about herbal based hair dyes and give info about how to make herbal hairdye at home.

LITERATURE REVIEW

1. Mahewash Pathan, Samartha Katte, Sagar S Sontakke, Laxmi Jamagondi et. al in their study on topic entitled "Development and evaluation of herbal hair dye formulation on 1/1/2019" they provided a study on Conventional methods of hair dyeing involve use of chemicals that result in unpleasant untoward effects which include irritation, breakage of hair, skin discoloration and cancer. In the context of above objective, the attempt was made to formulate a gel for hair dye containing herbal extract and other additives from plant source.[16]

2. Shubham Randad, Maya Mahadik, Dr. L.D. Hingane, et. al in their study on topic entitled "Formulation and Evaluation of Herbal Hair Dye" on 12/12/21 they concluded that, the herbal dye was formulated by using whole plant of aloe vera, leaves of henna, seeds of guava, flowers of nilika, amla, bhringraj, fenugreek, black catechu and reetha. The Ayurvedic cosmetics are very helpful and it is less prone any side effects. This herbal hair dye not only colours the hair, prevents the hair fall but also prevents excess sebum secretion results in preventing scalp itchiness and hair damage due to any condition or problem occurred in hairs.[17]

3. K. Sudheer Kumar, Afreen Begum, B. Shashidhar, et. al in their study on topic entitled "Formulationand evaluation of 100 % herbal hair dye" on 2/3/2016, they concluded that, Hair dyes include dyes modifiers, antioxidants, alkalizers, soaps, ammonia, wetting agents, fragrance, and a variety of other chemicals used in small amounts that impart special qualities to hair such as softening the texture orgive a desired action to the dye.[18]

4. Simone Aparecida da França, Michelli Ferrera Dario, Victoria Brigatto Esteves. et. al in their study on topic entitled "Types of hair dye and their mechanism of action" on 22/04/2015 in their study they state that, Hair dyes are classified, according to color resistance, into temporary. semi-permanent, demi permanent and permanent. Temporary dyes act through dye deposition on cuticles, but semipermanent may penetrate a little into the cortex and so the color resists up to six washes. In oxidation systems, there is an intense diffusion of the molecules into the cortex.[19]

5. Pazvadee Chaikal, Mayaree Kanlayavanttanakul, Nattaya Lourith et. al in their study on topic entitled "Hair loss and herbs for treatment" on 1/9/2022. The study aimed to evaluate the anti- skin aging efficacy of amla branch. Amis branch extract, a dark brown powder, consisted a variety of phenolic acids, mainly ferulic acids. The study results suggested that amla branch is rich source of bioactive compounds and can be a potential ingredient for utilization in anti-skinaging products.[20]

6. Rashmini Mallya, Padmini Ravikumar, in their study on topic entitled "Formulation and evaluation of natural hair colorants" on 27/10/2014 they concluded that, in present study the results indicate that except henna extract, other plant extracts used in this study do not impart color to human hair. A combination of extracts prepared by cold and/or hot extraction methods did not give encouraging results, but a formulation containing a combination of the studied plantpowders in 2% carbopol 934 gel shows promising results and does not produce skin irritation inrats.[21]

7. Rashmi Saxena Pal, Yogendra Pal, A.K Rai, et. al in their study on topic entitled "Synthesis andevaluation of herbal based hair dye" on 18/10/2018 study that, the 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. 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.[22]

8. J. Uttara, B. Swapnali, U. Mohini in their study on topic entitled "Formulation and preliminaryevaluation of natural hair colorant" on 19/01/2010. In the present investigation the formulations are developed using different combinations of Henna and Indigo along

with other herbs, the lossof colours in hair is due to various reasons like genetic influence, effect of environmental factors, use of alcoholic preparations etc. A need was felt to formulate a dye containing only plant products which is safe for use and does not have the problems of staining skin during use and hypersensitive reactions.[23]

9. Vijendra Singh, Mohammad Ali, and Sukriti Upadhyay in their study on topic entitled "Study of colouring effect of herbal hair formulation on greying hair" on 12/09/2015 The main objective of this study is to screen the hair colouring properties of hair colorant/herbal hair colouring formulations. The herbal drugs are used as hair colorants.[24]

10. Eman. A. Bydoon in their study on topic entitled "Extraction of natural dye from tea leaves andits application on Giza 86 Egyptian cotton fabric" on 9/01/2016. In this study the dyeing of cotton fabric with natural colorants extracted from tea leaves had been investigated. The resultsobtained revealed that microwave technique using ionized water (DI) with ferrous sulphate as pre-mordant after gelatin treatment gave the higher values compared with the other techniques,and the different solvents and mordants.[25]

PLAN OF WORK

The literature survey was carried out in following systematic manner.

Literature Review

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Collection of crude drugs

↓

Preparation of Formulation

↓

Evaluation of Formulation

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Blog Writing

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Result and Discussion

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Conclusion

A. Henna

4. PLANT PROFILE

Henna likewise lessens untimely turning grey of hair, since it is stacked with tannins, a plant compound found in a tea that adds to their rich shading. Henna contains vitamin E, which assists with mellowing hair. The natural leaves of the plant are rich in proteins and antioxidants that support hair health.[26]

Table No. 2: Plant Profile of Henna.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliospida
Sub-class	Rosidae
Order	Myrtales
Family	Lythraceae
Genus	Laoosonia.*L*
Species	*Laoosonia Inermis*. L

Figure No.5: Henna.

B. Amla

Amla powder upgrades the retention of calcium, assisting with making better bones, teeth, nails, and hair. It keeps up with the hair tone and forestalls untimely turning gray, reinforces the hair follicles. Amla is the most extravagant and concentrated type of Vitamin C alongside tannins found among the plants. The Vitamin C found in the natural product predicaments with tannins that safeguard it from being lost t by intensity or light. This amla powder is additionally plentiful in tannins, minerals like Calcium, Phosphorus, Fe and amino corrosive. The natural product is valuable for hair development and decrease balding. Amla has antibacterial and cell reinforcement properties that can assist with advancing the development of solid and shiny hair.[27]

Table No. 3: Plant Profile of Amla.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Sub Class	Rosidae
Order	Euphorbiales
Family	Euphorbiaceae
Genus	Phyllanthus. L
Species	*Phyllanthus emblica.* L

Figure No.6: Amla.

C. Reetha

Reetha is plentiful in vitamin A, D, E, K, saponin, sugars, unsaturated fats and adhesive. Reetha removes helpful for the advancement of hair development and decreased dandruff. Concentrate of organic product coat goes about as a characteristic cleanser, consequently is utilized in home grown shampoos as hair chemical Reetha as soapnuts or washing nuts, assume a significant part as normal hair care items since more established times. This plant is improved with saponins, which makes the hair solid, gleaming, and glossy when utilized on customary premise.[28]

Table No. 4: Plant Profile of Reetha.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Rosidae
Order	Sapindales
Family	Sapindaceae
Genus	Sapindus. L
Species	*Sapindus mukorossi*. L

Figure No.7: Reetha.

D. Shikakai

Shikakai is an astonishing spice that is ordinarily tracked down in the tropical woods of India. Shikakai is a strong normal home-grown plant that keeps on being utilized by age to age. Shikakai otherwise called "Acacia Concinna" for a long time presently, has been utilized as hair care fixing to clean their hair and reason is its various natural properties. Shikakai is otherwise called the hairnatural product as it gives various supplements to the hair and speeds up development. Shikakai is plentiful in cell reinforcements and nutrients like A, C, and K which makes a difference in keepingthe hair healthy and shiny.[29]

Table No. 5: Plant profile of Shikakai.

Kingdom	Plantae
Division	Magnoliophyta
Class	Eudicots
Order	Fabales
Family	Fabaceae
Genus	Senegalia
Species	*Senegalia rugata*

Figure No.8 Shikakai.

E. Tea powder

Tea powder Being rich in polyphenols, selenium, copper, phytoestrogens, melatonin, tea also hasbeen used in traditional Chinese medicine and in Ayurvedic medicine has been used since long as hair colourant.[30]

Table No. 6: Plant profile of Tea.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Dilleniidae
Order	Theales
Family	Theaceae
Genus	Camellia. L
Species	*Camellia sinensis*

Figure No.9: Tea Powder.

F. Bhringraj

Bhringaraj is a creeping herb that grows to a height of 3 metres. It has a long stalk and white coloured flowers which are solitary, winged and about 6 to 8 mm in diameter. The leaves are sessile, lance-shaped and arranged in the opposite orientation. It has distinct cylindrical and grey coloured roots 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. Bhringraj is used in the preparation of variousoil, shampoo, hair dye etc.[32]

Table No. 7: Plant profile of Bhringraj.

Kingdom	Plantae-Plant
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Asterales
Familly	Asteraceae / Compositae
Genus	Eclipta. L
Species	*Eclipta prostrata*. L

Figure No.10 Bhringraj.

G. Hibiscus

It is magnificent for expansion in hair development movement. Hibiscus is normally enhanced with Calcium, Phosphorus, Iron, Vitamin B1, Vitamin C, Riboflavin and Niacin, which help to advance thicker hair development and diminishes untimely turning gray of hair. This blossom is utilized for controlling dandruff Hibiscus displays cancer prevention agent properties by deliveringflavonoids, for example, anthocyanins and other phenolic compounds. Restoring the hair by molding it can be utilize.[33]

Table No. 8 Plant profile of Hibiscus.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Dilleniidae
Order	Malvales
Family	Malvaceae
Genus	Hibiscus L.
Species	*Hibiscus lunariifolius Wild*

Figure No.11: Hibiscus.

H. Coffee

In hair colorants, herbs can be used in the form of powder, aqueous extract] or their seed oil toimpart shades of different colour varying from reddish brown to blackish brown. Caffeine alsoimproves the blood circulation to your scalp, which in turn allows for nutrients to reach your scalp more efficiently. This results in a quicker and healthier hair growth. The herbal drugs likecoffee powder obtained from its seeds are used as hair colorants.[31]

Table No. 9: Plant profile of Coffee.

Kingdom	Plantae
Division	Mangnoliophyta
Class	Magnoliopsida
Sub class	Asteridae
Order	Rubiales
Family	Rubiaceae
Genus	Coffea. L
Species	*Arabica*. L

Figure No.12: Coffee.

I. Curry Leaves

The curry leaves murraya koenigii or bergera koenigii is a topical to the sub topical tree. The hypothesis is that the rich nutrients in curry leaves can help to prevent thinning hair or hair loss. The leaves may also help remove dead hair follicles, which can interfere with hair growth. Curry leaves are commonly known as kadi patta. It is just another spice that adds flavour to dals, chutneys, soups, and stews. Curry leaves are loaded with properties that can work wonders for your hair and lead to hair growth. follow these ways do a patch test for your safety.

Table No. 10: Plant profile of Curry Plant.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Sapindales
Family	Rutaceae
Genus	Murraya
Species	*M. koenigii*

Figure No.13: Curry leaves.

J. Fenugreek

Fenugreek's seeds contain trigonelline (active agent characteristic of the fenugreek), lots of mucilages, proteins, flavonoids, saponins, lipids, vitamins, iron and mineral salts (manganese, silicon, calcium and phosphorus). Fenugreek seeds have high protein and nicotinic acid content, which are known to be beneficial against hair fall and dandruff, and in treating a variety of scalpissues like dryness of hair, baldness and hair thinning. The seeds also help in moisturizing the hair and bringing back the luster and bounce.[41]

Table No. 11: Plant profile of Fenugreek.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Genus	*Trigonella*
Species	*T. foenum-graecum*

Figure No.14: Fenugreek.

K. Guava

These leaves have the ability to stop hair loss and make it grow back with vigour. It also helps to blacken the white hair. Guava leaves contain vitamin B and C, which help boost collagen activity required for hair growth. It has antioxidant, anti-inflammatory and anti-microbial properties which help to maintain a healthy scalp. The vitamin C content improves collagen activity aiding in hair growth and the lycopene content gives protection from sun's UV rays in the white hair.

Table No. 12 Plant profile of Guava.

Kingdom	Magnoliophyta
Division	Rosidae
Class	Rosidae
Order	Myrtales
Genus	Psidium
Family	Myrtaceae
Species	*Psidium guajava*

Figure No.15: Guava leaves.

5. EXPERIMENTAL WORK

6.1.MATERIALS AND METHODS

Plants: Henna, Amla, Reetha, Shikakai, Hibiscus, Coffee, Tea, Bhringraj, Curry leaves, Fenugreek, Guava.

6.1.1 Collection of Leaves

Fresh leaves of Henna collected from the village Bela, Dist. Nagpur, and the flower of Hibiscus from the local garden of Wardha, Maharashtra. Reetha, Shikakai, Tea, Amla, Bhringraj all in powdered form were procured from the authorized stores and local market in powdered form. Then all ingredients were pass through Sieve no 80, and this powdered were mixed uniformly to preparehomogenous formulation.

6.1.2 Cleaning and Drying of Plant material

The collected plant leaves were washed with water to remove unwanted dust and dirt and then sun dry for 5 days to remove the unwanted moisture from it, and then this dried leaf was powdered with the help of Mortar & Pestle.

Table No. 13: Ingredients of the prepared herbal hair dye.

Sr. Nos.	Ingredients	Quantity		
		Dark Brown(F1)	Pale Brown(F2)	Black(F3)
1	Henna	50 g	50 g	50 g
2	Amla	30 g	30 g	30 g
3	Guava leaves	5 g	5 g	5 g
4	Curry leaves	5 g	5 g	5 g
5	Reetha	10 g	10 g	10 g

6	Hibiscus	10 g	10 g	50 g
7	Bhringraj	10 g	10 g	10 g
8	Shikakai	10 g	10 g	10 g
9	Tea	10 g	20 g	10 g
10	Coffee	30 g	20 g	5 g
11	Indigo	20 g	20 g	5 g
12	Fenugreek	10 g	10 g	10 g

6.2 Equipment

All the material was procured from local market shop of Shraddha Ayurvedic Bhandar, Wardha and all the necessary laboratory equipment and apparatus were used for the formulation were used from the college laboratory of Dr. R. G. Bhoyar Institute of Pharmaceutical Education and Research, Wardha.

Table no. 14 Roles of ingredients in formulation.

Common Name & Scientific Name	Part Used	Uses	Figures
Henna (Lawsoniainermis)	Leaves	Natural hair dye, conditioner hair.	
Amla (Phylanthus emblica)	Fruits	Minimize grays, boost volume	
Reetha (Sapindus mukorossi)	Fruits	Cleanser for hair	
Shikakai (Acacia concinna)	Fruits	Control hair fall, Prevent split ends	
Hibiscus (Rosasinesis)	Flower	Prevent baldness, delays hair growing	
Bhringraj (Eclipta prostrata)	Whole Plant	Increase blood circulation to scalp&roots	

Guava (Psidiumguajava)	Leaves	Boost growth &volume	
Coffee(coffea)	Seeds	Improve dullness,relieve fizziness	
Tea (camelliasinesis)	Leaves	Keeps hair soft &shiny	
Fenugreek (Trigonnela foenumgraceum)	Seeds	Revives damage hair, control scalp inflammation	
Curry leaves (Murraya koenigii)	Leaves	Promotes hair growth,boost health of scalp	

6.3. Methods

6.3.1 Preparation of hair dye

- All the ingredients were weighed accurately according to the measured quantities given in theTable no.
- Collected ingredients were mixed and made into fine powder using mortar and pestle.
- Then obtained powder were passed through sieve to obtain uniform size.
- Then this mixed powder carefully transferred into a bag.

6.4. Application of Hair dye

This mixture of powder should be used weekly on wet hair, by forming a paste with water of optimum consistency. It should be applied on hair with use of brush, evenly. Then it should be leftfor 1-2 hours for drying purpose. Then it should be washed with plain water.

Fig. No. 16: Prepared Formulation.

6.5. Evaluation of Hair dye

The prepared hair dye was evaluated for its various organoleptic, physico-chemical, phyto-constituents as well as rheological parameter.

6.5.1. Organoleptic evaluation

Organoleptic characteristics for various sensory characters like color, odor and texture, etc. The raw drugs and powders were separately studied by organoleptic and morphological characters likecolour, odour, texture and appearance.

6.5.2. Phytochemical Evaluation

- The prepared polyherbal hair dye were subjected to Phytochemical evaluation for studying and reveal the presence or absence of various phytochemicals such as Carbohydrates, Sugar, Alkaloids and Lipids, *etc.*

A. Hager's Test (Test for alkaloids)

- 5g of mixture of a powder was taken and mixed thoroughly with distilled water and this obtained filtrate was used for further testing,
- Then from this filtrate 2ml of solution is taken and 3 drops of Hager's reagent was added and mark the result.

B. Molisch Test (Test for Carbohydrates)

- 5g of powdered was added with 5ml distilled water and mixed it thoroughly, filtered with

filter paper and this obtained filtrate was used to perform test.

- 2ml solution was taken from above filtrate and transferred into test tube having 2ml of distilled water in it.
- Then 2-3 drops of Molisch reagent was added along with 1ml of concentrated HCL to the above solution.

C. Foam Test (Test for Saponins)

- 5g of powder mixture was taken and add 5ml of distilled water to it and mixed thoroughly and the mixture was filter and obtain filtrate was used to perform test.
- 1ml of filtrate was transferred, and diluted with distilled water and volume was make up to 20ml.
- It was shaken for 15 minutes.

D. Fehling's Test (Test for detection of reducing and non-reducing sugars)

- 5g of powder was taken and add 5ml of distilled water to it and mixed and filter it and this filtrate was used for perform test.
- 2ml of filtrate was taken from above solution and 2ml of distilled water was added to it
- Then 1ml of Fehling's solution was added to it and heated for 1-2 minutes on water bath.

E. Bontrager's Test (Test for anthraquinone glycoside)

- 10ml of sulphuric acid was measured and add 1g of sample to it and boiled it.
- The above mixture was filtered and chloroform was added to the obtain filtrate.
- The organic layer separated to which ammonia was added slowly.

F. Test for Volatile Oils

- 5g of powder was taken and 5ml of distilled water was added to it and mixed thoroughly, and filter it and the obtain filtrate was used to perform test.
- 2ml of above filtrate was transferred into another test tube to which 2-3 drops of alcoholic solution of Sudan III.

G. Iodine Test

- 5g of powder mixture was taken and 5ml of distilled water was added to it and mixed thoroughly, filtered the above solution and the obtain filtrate was used to perform test.
- 2ml of above filtrate was transferred into another test tube and 2-3 drops of iodine solution wasadded to it.

6.5.3.Rheological Parameters

- Rheological parameters like bulk density, tapped density, angle of repose, Carr's index, Hausner's ratio.

A. Bulk Density

- 10g of product was taken in a 100ml of measuring cylinder.
- Bulk density was calculated by using following formula.
- Bulk Density = Mass of sample / Bulk Volume

B. Tapped Density

- 10g of sample was taken in a measuring cylinder.
- The cylinder was then placed on tapped density tester.
- After around 200 taps constant volume was obtained and tapped density was calculated using following formula:
- Tapped Density = Mass of sample / Tapped Volume

Figure No.17 Tapped Density Tester.

Figure No.18 Volume after tapping.

C. Angle of repose

- Clean and dry funnel was taken having 20-30mm of diameter.
- Then this funnel was attached with burette stand and surface where the stand was placed along with funnel and maintain the height of above 2 cm.
- Then placed Graph paper below the funnel to draw the circle along the pill.

- 10g of powder\ required quantity was poured form top of the funnel till the heap was formed on the surface.
- Then circle was drawn with a pencil around the heap.
- The of pill (h) and radius of the base (r) were measured with the ruler.
- Angle of repose θ was measured by given formula
- Angle of repose = $\theta = \tan^{-1} h\backslash r$.

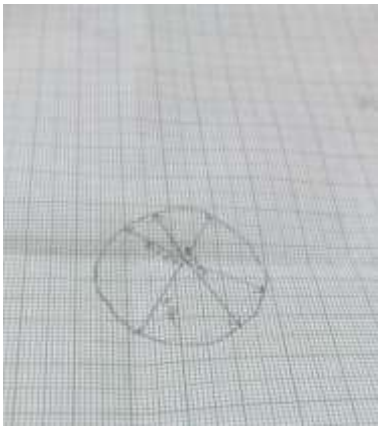


Figure No. 19 Angle of repose assembly. **Figure No. 20 Radius of Heap.**

D. Porosity

- It is calculated by subtracting True volume from Bulk volume, whole divided by bulk volume.

E. % Porosity

- It is calculated by porosity times 100.

F. Hausner's Ratio

- It is the ratio of Tapped density and Bulk Density times 100.

6.5.4. Physio-Chemical Evaluation

A. pH

- Add 10 g of sample in 10 ml of distilled water and then filtered it, then pH was calculated usingpH paper.

Figure No. 21 Solution of product

Figure No. 22 pH of paper

B. Percent Loss on Drying

- In crucible 2 g of sample was taken.
- Then it was heated till constant weight was obtained.
- Formula:
- Percent loss on drying = $\frac{\text{L.O.D}}{\text{Total mass of wet sample}} \times 100$

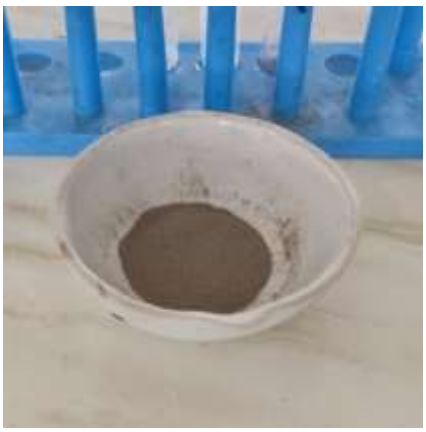


Figure No. 23 Loss on Drying.

C. Ash Value

- Weighed accurately 3 g of sample.
- Then this sample was placed in crucible and incinerated by increasing the heat gradually unitthe product was free from carbon and cooled it by keeping it in desiccators.

- Weighed the ash and calculated the total ash value and % of total ash.

Figure No. 24: Ash value.

6.6. Blog Writing and Publishing Online

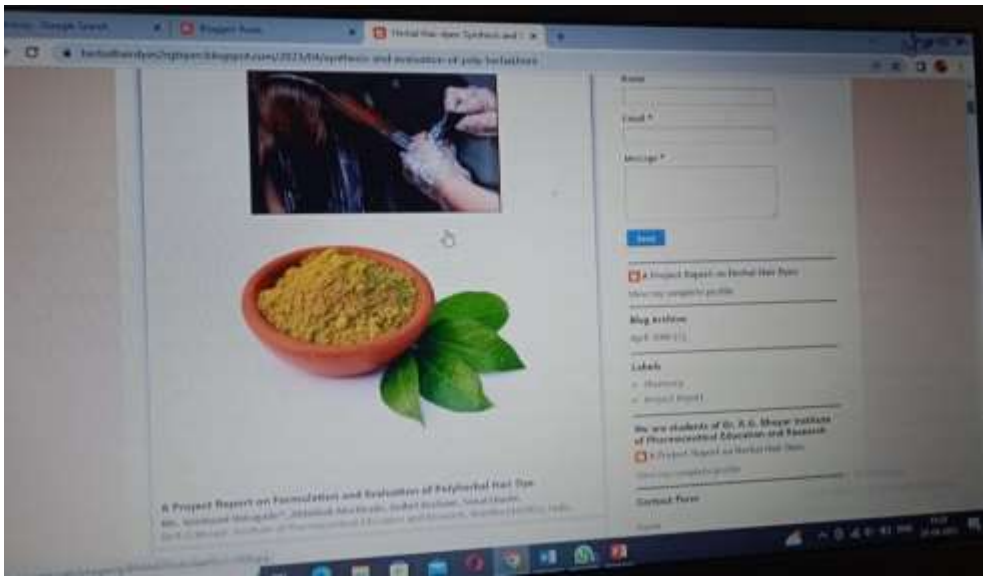


Figure No. 25: Online Blog.

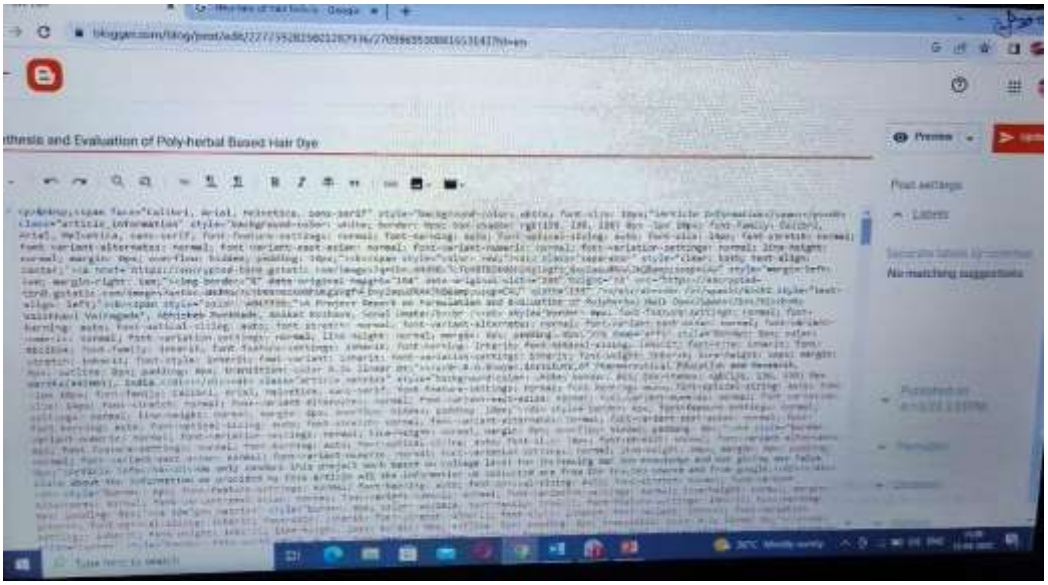


Figure No. 26: Overview of HTML code behind blog.

The above blog published on blogspot.com to about Herbal hair dye over chemical hair dyes. Many People are not aware of risk of chemical based dyes and not believing on Herbal hair dye. So, the main motive of writing and publishing this blog is to make people aware about the benefits of Herbal hair dye.

RESULT AND DISCUSSION

7. RESULT

7.1.Evaluation of Hair Dye

7.1.1.Organoleptic Evaluation

Table No. 15: Organoleptic Evaluation.

Sr No.	Organoleptic Evaluation	Results
1	Colour	Greenish Brown
2	Odour	Characteristic
3	Texture	Fine
4	Appearance	Powder

7.1.2. Physio-Chemical Evaluation

A. pH

pH of the product was found to be 7.0

B. Ash Value

i) Calculations

a) Total Ash value

Weight of empty crucible: 71.262 g Weight of product +crucible: 74.437 g Weight of

product: 74.437 g – 71.262 g

= 3.17 g.

After Incineration

Total weight of crucible+ ash = 71.455 g

Total ash value = Total weight –Weight of crucibleTotal ash value = 71.455 – 71.262

= 0.193 g.

b) Percent Ash value = $\frac{\text{Weight of ash}}{\text{Weight of product}}$ x 100

= 0.06088 x 100

= 6.088 %

C. Percent Loss on Drying

i) Calculations

Weight of empty crucible [A] = 70.390 g Weight of product + crucible = 73.38 g Weight of product taken [B] = 2.99 g (3.0 g)

Weight of crucible + product (before heating) [C] = 73.38 g Weight of crucible + product (after heating) [D] = 73.31 g Weight of loss on heating (L.O.D) [E = C- D] = 73.38 – 73.31

= 0.07 g.

Total mass of wet sample = D – A

= 73.31 g – 70.390 g

= 2.92 g

= $\frac{0.07 \text{ g}}{2.92 \text{ g}}$ x 100

= 0.02397 x 100

= 2.39 %

Table No. 16: Physio-chemical Evaluation.

Sr. Nos.	Parameters	Results
1.	pH	7.0
2.	L.O.D	2.39 %
3.	Ash Value	0.193 g
4.	% L.O.D	2.39 % w/w
5.	% Ash Value	6.088 %

A. Rheological Evaluation

A. Bulk Density

Bulk Density = Mass of sample / Bulk Volume

= 10.032 / 30

= 0.33 g/ml

B. Tapped Density

Tapped Density = Mass of sample / Tapped Volume

= 10.032 / 15

= 0.66 g/ml

C. Angle of Repose

Angle of Repose = $\theta = \tan^{-1}$ h\r.

$\theta = \tan^{-1}$ h\r. 2/2.625θ = 37.30 °.

D. Carr's Index/Compressibility Index:

Carr's Index/Compressibility Index = (Tapped Density – Bulk Density) / Tapped Density

= (0.66 – 0.33) / 0.66 x100

= 49.34

E. Hausner's Ratio

Hausner's Ratio = Tapped Density / Bulk Density

= 0.66 / 0.33

= 2.0

F. Porosity

Porosity = (Bulk Volume – True Volume) / Bulk Volume

= 30 - 15

30

= 0.5

G. % Porosity = 0.5 x 100

= 50 %

Table No. 17: Rheological evaluation.

Sr.no.	Parameter	Result
1.	Bulk Density	0.33 g/ml
2.	Tapped Density	0.66 g/ml
3.	Angle of Repose	37.30°
4.	Carr's Index	49.34
5.	Hausner's Ratio	2
6.	Porosity	0.5
7.	% Porosity	50 %

B. Physio-chemical Evaluation

Table No. 18 Physio-chemical Evaluation.

1.	pH	 **Figure No. 38**	pH was found to be 7.0,that is neutral.
2.	Ash Value	 **Figure No. 39**	0.193 g
3.	Percent Ash Value		6.088 %
4.	Loss on Drying	 **Figure No. 40**	0.07 g
5.	% Loss on Drying		2.39 %

C. Rheological Evaluation

Table No. 19 Rheological Evaluation.

1.	Bulk Density	 **Figure No.41**	0.33 g/ml
2.	Tapped Density	 **Figure No. 42**	0.66 g/ml
3.	Angle of repose	 **Figure No. 43**  **Figure No.44**	37.30 °. That is passable.
4.	Cars Index		49.34. That is extremely poor.
5.	Hausner's Ratio		2.Very poor.
6.	Porosity		0.5
7.	Percent Porosity		50 %

D. Phytochemical Evaluation

Table No. 20 Phytochemical Evaluation.

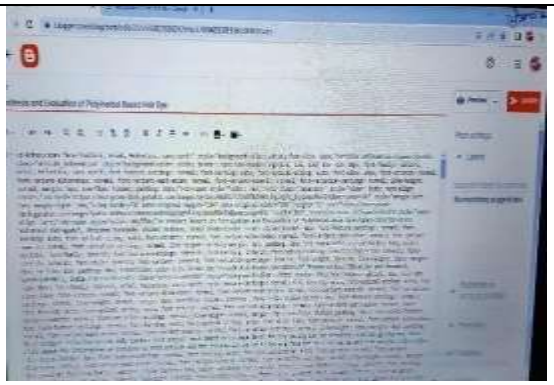
1.	Foam Test	 **Figure No. 45**	Saponin are present.

2.	Molisch Test	 **Figure No. 46**	Carbohydrates are present.
3.	Fehling's Test	 **Figure No. 47**	Reducing and non-reducingsugars are absent.
4.	Hager's Test	 **Figure No. 48**	Alkaloids are present.
5.	Bontrager's Test	 **Figure No. 49**	Anthraquinone glycosides areabsent.
6.	Iodine Test	 **Figure No. 50**	Starch is absent.

7.	Volatile Test	 **Figure No. 51**	No volatile oils are present.

E. Blog writing and publishing

Table No. 21: Visual Representation of HTML view of our Blog.

1.	Blog writing and publishing	 **Figure No. 52**	Online Blog was published and main motive of this blog writing and publishing is to aware people about herbal based hair dye.

7.2.DISCUSSION

1. Preparation of Herbal hair dye

Formulation was prepared from necessary laboratory equipment's and required materials werepurchased from the local market of Wardha.

2. Evaluation of herbal hair dye

A. Organoleptic Evaluation: It includes the analysis of organoleptic properties of the formulationsuch as colour, odour, texture etc.

- Colour of the formulation was found to be Greenish Brown.
- Odour of the formulation was found to be characteristic odour.
- Texture of the formulation was found to be Fine texture.

B. Physicochemical evaluation

This evaluation involved the analysis of physicochemical properties of formulation such as pH,ash value, loss on drying, etc.

- **pH** of the formulation was found to be 7, i.e. neutral. Neutral pH is considered to be desirableas the formulation will not cause any irritation to scalp and will not damage hair

follicle.

- **Ash value of the formulation** was found to be 0.19 g. which was similar to our referred article.
- **Percent ash** value was found to be 6.312 %.
- **Loss on drying** was found to be 2.0 % which was nearly equal to our referred article.

C. Phytochemical Evaluation

This evaluation involved the detection of presence of phytoconstituents such as saponins carbohydrates, glycosides, etc.

- **Foam test** result was positive as stable foam was observed indicating the presence of saponins.
- **Molisch Test** result was positive as purple coloration at the junction of the junction of the twoliquids was observed indicating the presence of carbohydrates.
- **Fehling's Test** result was negative as blue coloration was observed indicating the absence ofreducing and non-reducing sugars (Aldehyde and alpha-hydroxy-ketone).
- **Hager's Test** result was found to be positive as yellow colour precipitate was observedindicating the presence of alkaloid**s.**
- **Bontrager's Test** result was negative as no pink coloration was observed indicating the absenceof anthraquinone glycosides.
- **Iodine Test** was negative as orange coloration was observed indicating the absence of starch.
- **Volatile oils Test** result was negative as no red coloration was observed indicating the absenceof volatile oils in the formulation.

D. Rheological Parameters

Physical parameters like untapped or bulk density, tapped density, the angle of repose, Hausner'sratio, and cars index were observed and calculated for the inhouse formulation.

- **Bulk Density** of the formulation was found to be 0.33 g/ml which was nearly similar to ourreferred article.
- **Tapped Density** of the formulation was found to be 0.66g/ml which was nearly close to thevalues indicating in the referred article.
- **Angle of repose** was found to be37.30° which on comparing with the values given in table,indicates our powder formulation is passable.

Table No. 22: Angle of Repose.

Angle of Repose	Flowability
<25	Excellent
25-30	Good
30-40	Passable
>40	Very poor

- **Carr's Index** was found to be 49.34. That is extremely poor on comparing with below table.

Table No. 23 Carr's Index.

% Compressibility	Relative flowability
5-15	Excellent
122-16	Good
18-21	Fair
23-28	Slightly Poor
28-35	Poor
35-38	Very Poor
>40	Extremely Poor

- **Hausner's Ratio** was found to be 2, which is very poor flow character on comparing with Tablebelow

Table No. 24 Hausner's Ratio.

Hausner's Ratio	Flow Character
1.00-1.11	Excellent/ Very free flow
1.12-1.18	Good/ Free flow
1.19-1.25	Fair
1.26-1.34	Passable
1.35-1.45	Poor/ cohesive
1.46-1.59	Very Poor/ Very cohesive
>1.60	Very, very poor/ approximately non-flow

- **Porosity** was found to be 0.5.
- **Percent Porosity** was found to be 50 %.

3. Blog Writing and Publishing: The blog was published on blogspot.com and the primary motiveof writing this blog is to aware the people about the benefits of herbal based hair dye over chemicaldye.

CONCLUSION

According to our study findings, an appropriate black colour for hair may be obtained by varying the proportions of henna and Indigo. This natural herbal hair colorants are excellent for people of all age group and the formulation and processing methods are eco-friendly. Hence, we discovered the beneficial qualities of natural herbal dye in our study; however, an additional research is needed to discover more helpful advantages of this herbal hair pack. Thus, the herbal formulations are indemand to satisfy the expectations of an expanding global market.

The advantages of herbal based dye are their non-toxic nature it nitrifies 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. 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 effect are affect as compared to the chemical-based products. Herbal formulation is in great demand t fulfil the needof the growing world market. It is noticeable attempt to formulate the herbal hair pack, containingthe goodness of different plants, which are excellent for hair care.

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It help me increases my knowledge and skills.

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