

Formulation and Evaluation of Herbal Hair Dye

Mr. Abhishek Rajesh Dhapse^{1*}, Mr. Waghmare, S. U², Mr. Dhananjay Dubile¹, Mr. Limbaji Gaware¹, Mr. Vaibhav Jadhav¹

¹UG Scholar of Rashtriya College of Pharmacy, Tq. Kannad Dist. Chh.Sambhajinagar, Maharashtra, India-431103

²Assistant Professor of Rashtriya College of Pharmacy, Tq. Kannad Dist. Chh.Sambhajinagar, Maharashtra, India-431103

DOI: [10.36348/sjbr.2024.v09i05.004](https://doi.org/10.36348/sjbr.2024.v09i05.004)

| Received: 07.06.2024 | Accepted: 11.07.2024 | Published: 23.07.2024

*Corresponding author: Mr. Abhishek Rajesh Dhapse

UG Scholar of Rashtriya College of Pharmacy, Tq. Kannad Dist. Chh.Sambhajinagar, Maharashtra, India-431103

Abstract

Herbal based hair dyes are being preferred on large scale; due to 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. Loss of colour in hair is due to varied reasons like genetic influence, effect of environmental factors of alcoholic preparations etc. Graying of hair is a natural phenomenon attributable to ageing and frequent use of synthetic shampoos which has encouraged application of synthetic dye with the increase in the usage of hazardous chemicals in the process of manufacturing. The main aim of the formulation and evaluation of herbal hair dye is to minimize the side effects of synthetic and semi synthetic hair dye.

Keywords: Formulation, Evaluation, herbal hair dye, Antiseptic property.

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1. INTRODUCTION

Natural herbal dyes are becoming more and more popular as an alternative to chemical-based hair dyes that can lead to skin-related illnesses. Herbal medications that have no negative side effects are used for healthy hair. About 70% of people over 50 suffer from baldness and graying of the hair. Plant products are derived from any part of the plant, including bark, leaves, flowers, seeds, and more. Plant products have long been used in phytomedicine. It was felt that a product made entirely of plant products was needed.

- In the present investigation the formulations are developed to get natural black colour using combination of different plant materials. The dye was prepared based on experiences of several people who were using different plant products for colouring their hair without having any problems of irritancy, allergy or sensitivity.
- Because of their inherent goodness and lack of negative effects, herbal medicines with a base in herbs are becoming more and more in demand. Well-known ayurvedic herbal drugs that have historically been used as hair colorants and for hair growth include amla, bhringraj, henna, jatamansi, reetha, methi, lohhasma, orange peel powder, brahmi, and shikakai.

- Before modern hair dyes were developed, a wide variety of plant extracts were utilized in Europe and Asia for hair coloring. You might blend indigo, often called first fabric dye, with henna to create a variety of light brown to black hues for your hair color. Unpleasant side effects from using these chemicals include skin irritation, allergies, hair breakage, skin discoloration, unexpected hair color, and more.
- When such substances are applied often to natural hair, they can have a number of negative effects, including erythema, dry scalp, hair loss, irritation of the skin, and even skin cancer. Henna has long been used in India to color hair and palms. Numerous herbs, including bhringraj, jatamansi, amla, methi, reetha, and shikakai, are key ingredients in hair care products that are primarily intended for hair colouring [1].

2. Anatomy of the Hair:

The hair follicle is a multi-layered, detecting, reacting skin appendage that serves several essential functions. For optimal functioning, it needs a certain molecular environment. Animal skin serves as an insulating covering, but it also helps with survival

camouflage and is believed to convey tactile and sensory information about the surroundings.

Human hair follicles typically emerge in the first trimester and are created as a result of epidermal-dermal interactions. The process of growing hair is unique and complex, consisting of an ongoing cycle of growth, resorption, rest, and renewal. Due to their constant exposure to the elements, hair follicles commonly sustain direct damage from the sun, air, and water.

Structure:

During the first trimester of pregnancy, hair follicles are created. The interactions between the epidermis and the dermis form them. A tabular pocket-like structure called a hair follicle houses the epidermis.

Externally, the hair follicle is divided into three segments.

- **Infundibulum:**

It reaches the level of the sebaceous gland opening in a follicle from its surface opening. The pilosebaceous canal includes the infundibulum, which serves as a conduit for sebum outflow.

- **Isthmus:**

The isthmus reaches the level of the arrector pili muscle's insertion from the infundibulum.

- **Inferior Segment:**

This is the area where the follicle is expanding to produce the bulb, with the exception of its base, where its diameter is almost uniform. The dermal papilla, a loose tuft of vascularized connective tissue, invaginates the base of the bulb to produce a pouch. Numerous blood vessels can be found in the hair papilla, which also feeds the developing hair.

The germinal layer, or matrix, is a ring of cells found in the bulb as well. They are in charge of maintaining the growth of already-existing hairs and, when older hairs fall out, dividing cells to create new ones [2].

Figure A shows the internal structure of hair by showing the cross-sectional anatomy of a hair and hair follicle.

Depicting the internal structure of hair:

- **Sebaceous Glands:** By secreting sebum, these glands protect and lubricate the scalp and hair. The hair follicles are where the sebaceous glands open directly.
- **Arrector pili:** The autonomic nerve system regulates these involuntary muscles. They run parallel to the hair follicle and are linked to its center. The muscles of the arrector pili contract when a person feels fear or cold, which causes horripilation, or the standing up of the hair.

- **Hair Shaft:** This is the portion of hair that is found beneath the skin's surface. The hair root is the portion of the hair that is beneath the skin's surface.

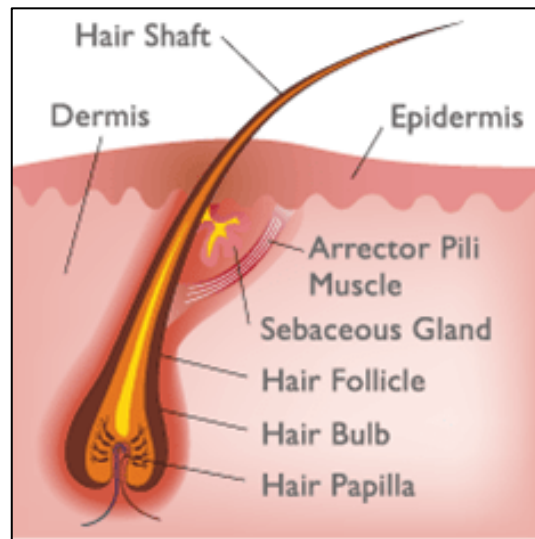


Fig A: Structure of Hair Root

- **Hair Bulb:**

The term refers to a structure that resembles a bulb that is located at the end of a hair root. The dermal papilla, a centrally located, vascularized and innervated portion of the hair bulb. The dermal papilla is in charge of generating and growing hair by taking in oxygen and nutrients. Hair cells that develop to make hair produce the hair matrix, just like nail matrix does. Nutrition is absorbed by the hair matrix through the capillaries that enter the dermal papilla. An expanded representation of the hair bulb is shown in Figure B.

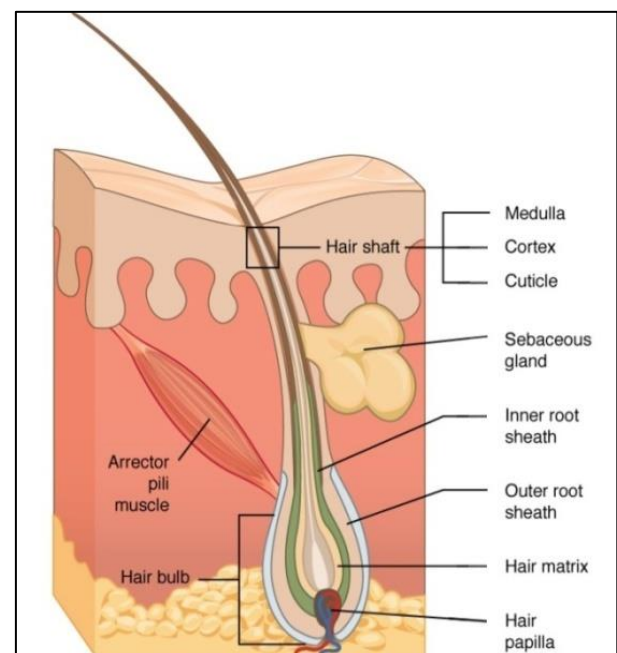


Fig B: Diagram of Hair bulb

The line that splits a hair bulb into lower and higher halves based on the maximal diameter is known as the Auber critical level. The region below this line is what causes the quickly dividing undifferentiated cells, whereas the region above this line exhibits minimal cell division.

➤ **Functions:**

- The hair on the head cushions the head, insulates the skull, and shields the scalp from UV rays.
- The brows shield the eyes from insects and tiny foreign objects. Also, they deflect perspiration from the eyes.
- Vibrissae, the hairs that cover the openings to the external ear canals and nose, filter the air and aid in keeping out tiny insects and unwanted objects.
- Body hair aids in sweat evaporation and external drainage [3].

➤ **Reasons Behind the White Hairs:**

• **Pigmentation of the Hair:**

One of the most distinctive characteristics of humans is their hair color, which can range from red to black, brown, and blonde. Melanocytes, which are derived from the neural crest, generate the pigment melanin, which gives human hair its color. Two different forms of melanin are found in human hair follicles: eumelanin and pheomelanin. The diversity of hair color arises mostly from the quantity and ratio of black-brown eumelanin and reddish-brown pheomelanin. It has been hypothesized that the pH and cysteine level of melanosomes influences the phenotype of hair. As pH reduces, there is a progressive reduction in tyrosinase activity leading to increased pheomelanin and reddish or blonde hair. A mutation in melanocortin-1 receptor (MC1R) gene causes auburn or red color of hair. This mutation is seen usually in individuals of Northern Europe with less sun exposure. A study in 2012 showed a recessive mutation in tyrosinase-related protein 1 (TYRP1) in people with blonde hair

The pigmentation of the skin and hair differs in a number of ways. In the hair bulb, each melanocyte is connected to five keratinocytes, creating a unit known as the "hair follicle-melanin unit." On the other hand, a "epidermal-melanin unit" is made up of 36 keratinocytes that are connected to each melanocyte in the skin. In contrast to the skin, where pigment creation occurs continuously, the stages of the hair cycle are strongly linked to melanogenesis in the hair. In the anagen phase, hair actively pigments; in the catagen and telogen phases, hair is "turned off" and missing.

In pigmented hair, the pigmentary unit is a pear-shaped black structure located at the tip of the dermal papilla. Gray hair is characterized by a fuzzy pigmentary unit, few, spherical melanocytes, and visible, light-colored oligodendritic melanocytes in the proximal hair

bulb. Melanocyte counts in hair follicles are significantly reduced during anagen due to autophagolysosomal degeneration, which results in pigment loss. Melanocytes and hair follicle stem cells are influenced by both genetic and environmental factors. This aging process has been linked to telomere shortening, a decline in cell number, and specific transcription factors. These molecular changes cause structural changes in the hair fiber, a reduction in the synthesis of melanin, and an extension of the telogen phase of the hair cycle.

Numerous genes and signaling pathways that affect hair pigmentation are being investigated at the molecular level. It is well established that activins and receptors for bone morphogenic protein, specifically Bmpr2 and Acvr2a, affect hair color. In experimental mice, diminished Bmpr2 and Acvr2 activity can lead to early graying. Numerous biological activities are influenced by the Notch signaling pathway. It has been suggested that the Notch 1 and Notch 2 signaling pathways are involved in the preservation of hair color. A cytokine called stem cell factor (SCF) is involved in numerous [4].

3. AIM: Formulate and evaluate herbal hair dye

OBJECTIVES:

- A list of justifications for hair coloring.
- Describe how the porosity of the hair influences its color.
- Comprehend the many forms of melanin present in hair.
- Describe and distinguish levels as well as their function in creating hair color.
- Recognize colors that are primary, secondary, and tertiary.
- Understand how tone and intensity affect the color of your hair.
- Enumerate and explain the many types of hair color.

4. MATERIALS AND METHOD

➤ **Natural Ingredients used in The Formulation 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 herbal, also acts as a hair growth promoter, hair nourisher, conditioner and anti-dandruff agent as well as Amla, Coffee, Custard apple pulp powder, Henna and Hibiscus [5].

- a. AMLA (*Emblca officinalis*)
- b. COFFEE (*Coffea arabica* Linn.)
- c. HENNA (*Lawsonia inermis*.)
- d. HIBISCUS (*Hibiscus rosa*.)
- e. SHIKAKAI (*Acacia concina*)

➤ **Drug's Profile**
a. AMLA



Fig 1: Amla

Synonyms: Emblica, Indian goose berry, Amla.

Biological Source

This consists of dried, as well as fresh fruits of the plant “*Emblica officinalis*”

Family: Euphorbiaceae.

Geographical source

It is a small or medium-sized tree found in all deciduous forests of India. It is also found in Srilanka and Myanmar.

Chemical constituents

- Vitamin C (Ascorbic acid),
- Alkaloids (Phyllanthin),
- Carbohydrates(Pectin),
- Hydrolysable Tannis (Emblicanin A & B).

Uses

- Condition your scalp
- Promote healthy hair growth.
- Improve the tone of henna hair dye
- Minimize grays
- Reduce dandruff

b. COFFEE



Fig 2: Coffee

Synonyms: Coffee bean, Coffee seed, Arabica coffee, Abyssinian coffee, Brazilian coffee.

Biological source

It is the dried ripe seeds of “*Coffee arabica* Linn.

Family: Rubiaceae.

Geographical source It is indigenous to Ethiopia, Brazil, India, Vietnam, Mexico, Guatemala, Indonesia and Sri Lanka.

Chemical constituents

- Caffeine
- Tannin
- Fixed oil
- Proteins

Uses

- Applying coffee topically to hair and the scalp might stop hair loss and promote regrowth.
- Sprinkle coffee grounds in your backyard to repel snails and fleas.
- Reuse coffee grounds to exfoliate our scalp to unclog hair follicles.
- Create a vintage look on clothes or napkins by using coffee.
- Make coffee oil to lighten and brighten the eye area.
- Mix coffee grounds with body wash for a body and foot scrub.

c. HENNA (*Lawsonia inermis*.)



Fig 3: Amla

Synonyms: *Alcanna spinosa*, *Casearia multiflora*, *Lawsonia alba*, *Lawsonia speciosa*, *Lawsoniaspinosa*, *Lawsonia* and *Rotantha combretoides*.

Biological source

The plant “*Lawsonia inermis*”, well known for its cosmetic and therapeutic virtues. Henna leaves are natural sources of colour for hand, feet, fingers, nail and hair.

Family: Lythraceae

Geographical sources: The henna plant is native to Northern Africa and it is also found in Western and Southern Asia.

Chemical constituents

- Lawsone (2-hydroxy 1,4-naphthoquinone)
- Sugars (glycosides)
- Tannins (gallic acids).

Uses

- Henna repairs the damaged hair strands and restores the acid-alkaline balance of the scalp. Henna is best to colour hair and has no chemicals, toxins and ammonia.
- It is also used for protecting hair from sun and dust. Henna can also make hair strong.
- It can be used to the dandruff and scalp infections effectively.
- Henna is used in cosmetics, hair care products and also used as a dye for hands, clothing and nails

d. HIBISCUS (*Hibiscus rosa*)



Fig 4: Hibiscus

Synonyms: Shoebblack plant, Mahagua, Mahoe, Cotton rose, Roselie, Jamaica sorrel, China rose.

Biological sources

It is obtained from flowers of “*Hibiscus rosa sinensis* Linn.”

Family: Malvaceae

Geographical sources

The hibiscus plant is Native to tropical Asia, China and Philippines.

Chemical constituents

- Ascorbic acid
- Thiamine
- Citric acid
- Glucose
- Fructose
- Oxalic acid

Uses

- Leaves and flowers can be used as a hair growth promoter and to prevent premature graying and to treat scalp disorders.
- The flowers of “*Hibiscus rosa sinensis*” can be used to control high blood pressure, stomach pain, liver diseases, etc.
- *Hibiscus rosa sinensis* can be used as a diuretic.

e. SHIKAKAI (*Acacia concina*)



Fig 5: Shikakai

Synonyms: Soap -pod, *Acacia concinna*.

Biological source

Shikakai, is a shrub-like tree native to Central India. *Acacia concinna* (Leguminosae), a climbing shrub with oblong-shaped dark brown pods, bipinnate leaves, and pink flowers. It is typically found in the Indian subcontinent's tropical woods.

Family: Mimosaceae

Geographical Source:

Acacia concinna (Hindi name - Shikakai) is a climbing shrub native to Asia, common in the warm plains of central and south India. The plants are medium fast growing and which is bushy cum creeper.

Chemical Constituents-

- Arabin,
- L-arabinose,
- L-rhamnose,

- D-galactose
- D-glucuronic acid.

Uses

- Cleansing, promote hair growth and reduce Dandruff
- For hundreds of years, Shikakai has been used in India for hair treatment.
- To nourish and speed up the growth of hair [6].

➤ Methods of Hair Dye Preparation

i. Weighing

After that, a worker weighs out the batch's ingredients. There are some components that the batch needs very little of. However, if a sizable batch is being prepared and a substantial quantity of multiple ingredients are required.

ii. Mixing

When using a formula that doesn't call for pre-mixing, the ingredients are just combined after being checked and weighed. All of the ingredients are thoroughly combined.

iii. Completing

The completed hair coloring product batch was placed in the filling section. Subsequently, the hair dye measurement on the balance.

iv. Presentation

The plastic bags are transported to the packaging line from the filling area. The product is fully packaged, and its label provides comprehensive information. After that, the product is brought to the warehouse where it will be distributed [7].

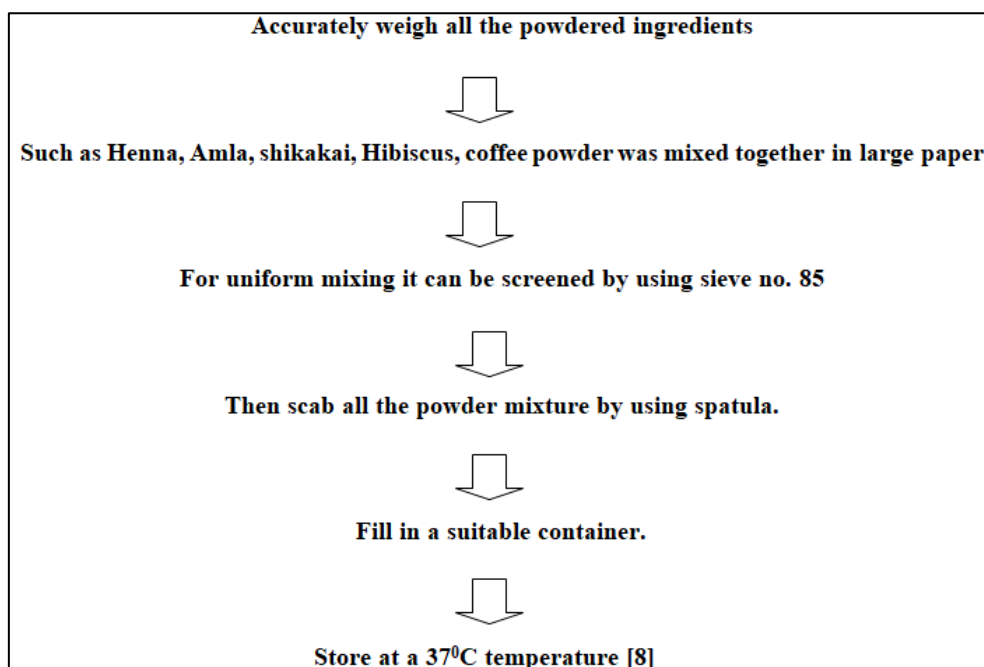
5. Experimental work

➤ Formulation of Herbal Hair Dye:

Table 1: Formulation of hair dye

Sr. No	Ingredients	Quantity	Uses
1	Amla	8gm	To reduce Dandruff
2	Coffee	3gm	To stop hair loss
3	Henna	8gm	Make hair strong
4	Hibiscus	3gm	To promote hair growth
5	Shikakai	3gm	Speed up of growth of hair
6	Water	Sufficient amount	Used as a solvent(for applying the hair dye)

➤ Procedure:



➤ Evaluation of the herbal hair dye

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

• Organoleptic evaluation

Organoleptic characteristics for various sensory characters like colour, odour, taste etc. was 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.

Table 2

Sr. No	Parameter	Formulation
1	Colour	Greenish brown
2	Odour	Characteristic
3	Texture	Fine
4	Apperence	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. reflect the above findings

Table 3

Sr. No	Parameters	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 Pytochemical 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 were used to the presence of carbohydrates. The aqueous extract of formulated herbal face pack was evaluated for the presence or absence of different phytoconstituents as pre standard procedure and norms.

Table 6

Sr. No	Parameters	Room Temperature	35°C
1	Colour	No Change	No Change
2	Odour	No Change	No Change
3	pH	6.5	6.5
4	Texture	Fine	Fine
5	Smoothness	Smooth	Smooth

6. RESULT AND DISCUSSION

Herbal hair packs colour the hair in the most gentle manner. The advantage of herbal-based cosmetics is their nontoxic nature. It nourishes the skin of the scalp and hair. Hair formulations provide vital nourishment for the skin. It helps to treat dandruff by removing excess oil from the scalp. Pollution, ageing, stress, and harsh climates badly affect the quality of hair. In this exploration, we found powerful properties of home-grown hair packs, and further examinations are required to investigate more helpful advantages of this natural hair pack. Natural cures are generally acknowledged with open hands these days as they are more secure and have negligible secondary effects when compared with synthetic-based items. Homegrown plants are extremely popular to satisfy the temperaments of the developing market. It is an observable endeavour to figure out the

Table 4

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

- **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 prepered 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.

Table 5

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

- **Stability test**

Stability testing for the prepared formulation was preformed 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.

natural hair dye containing the decency of powders of various plants, which are incredible for hair care.

7. 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. A herbal hair pack colours the hair in an at most gentle manner.

The advantages of herbal based cosmetics are non-toxic in 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 soil 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 formulation are in great demand to fulfill the needs of the growing world market. It is noticeable attempt to formulate the herbal hair pack containing the goodness of powder of different plant, which are excellent for hair care.

REFERENCE

1. Pal, R. S., Pal, Y., Rai, A. K., Wal, P., & Wal, A. (2018). Synthesis and evaluation of herbal based hair dye. *The Open Dermatology Journal*, 12(1). DOI: 10.2174/1874372201812010090, 2018, 12, 90-98
2. Rahmadeni, A. S., Hayat, N., Alba, A. D., Badri, I. A., & Fadhila, F. (2020). The relationship of family social support with depression levels of elderly in 2019. *International Journal of Health & Medical Sciences*, 3(1), 111-116. <https://doi.org/10.31295/ijhms.v3n1.188>.
3. Slodowink, D., & Nixon, R. (2007). Occupational factors in skin diseases. *Current Problems in Dermatology*, 35(2), 173-89. [http:// dx. doi. Org/10.1159/000106423](http://dx.doi.org/10.1159/000106423).
4. Ali, N. F., & El-Mohamedy, R. S. R. (2011). Eco-friendly and protective natural dye from red prickly pear (*Opuntia Lasiacantha Pfeiffer*) plant. *Journal of Saudi chemical society*, 15(3), 257-261. [<http://dx.doi.org/10.1016/J.jscs.2010.10.001>].
5. Guo, E. L., & Katta, R. (2017). Diet and hair loss: effects of nutrient deficiency and supplement use. *Dermatology practical & conceptual*, 7(1), 1-10. doi: 10.5826/dpc.0701a01, PMID 28243487.
6. Habbal, O., Hasson, S. S., El-Hag, A. H., Al-Mahrooqi, Z., Al-Hashmi, N., Al-Bimani, Z., ... & Al-Jabri, A. A. (2011). Antibacterial activity of *Lawsonia inermis* Linn (Henna) against *Pseudomonas aeruginosa*. *Asian Pacific journal of tropical biomedicine*, 1(3), 173-176. doi: 10.1016/S2221-1691(11) 60021-X, PMID 23569753.
7. Semwal, R. B., Semwal, D. K., Combrinck, S., Cartwright-Jones, C., & Viljoen, A. (2014). *Lawsonia inermis* L.(henna): Ethnobotanical, phytochemical and pharmacological aspects. *Journal of ethnopharmacology*, 155(1), 80-103. doi: 10.1016/j.jep.2014.05.042, PMID 24886774.
8. Andoh, S. S., Nyave, K., Asamoah, B., Kanyathare, B., Nuutinen, T., Mingle, C., ... & Roussey, M. (2020). Optical screening for presence of banned Sudan III and Sudan IV dyes in edible palm oils. *Food Additives & Contaminants: Part A*, 37(7), 1049-1060. doi: 10.1080/19440049.2020.1726500, PMID 32077804.