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**FORMULATION AND EVALUATION OF NATURAL HAIR DYE****TIRTH THAKER\*, KRUPA PADARIYA AND BHAKTI VYAS**Department of Chemistry, Parul Institute of Applied Sciences, Parul University, Waghodia,  
Vadodara-391760, Gujarat, India**\*Corresponding Author: Dr. Tirth Thaker: E Mail: [tirth6582@gmail.com](mailto:tirth6582@gmail.com)**Received 24<sup>th</sup> Sept. 2023; Revised 25<sup>th</sup> Oct. 2023; Accepted 8<sup>th</sup> Jan. 2024; Available online 1<sup>st</sup> Oct. 2024<https://doi.org/10.31032/IJBPAS/2024/13.10.8403>**ABSTRACT**

Among the various reasons for hair colour loss are genetic factors, environmental parameters, alcoholic beverages, and various other factors. Although permanent, manufactured hair colours are available in an extensive variety of colours that preserve their natural beauty. We have observed that some hair dyes effect on the health of hair. So, in present study natural ingredients are utilized to innovate natural dye. Hair dye design was considered reasonable to detail using *Lawsonia inermis* and *Indigofera tinctoria* standard colouration. During the present research, measures have been taken to develop a powdered, locally produced colouring product that provides hair with a shade of black.

**Keywords: Hair colourants, Herbs, *Lawsonia inermis*, *Indigofera tinctoria*****INTRODUCTION:**

Naturally plant-based dyeing has become popular today over chemical-based colour for hair because they don't contribute to allergic conditions or similar hair-related illnesses [1]. Several powdered herbs and hair-care botanical mixtures, including those made with *Lawsonia inermis*, *Indigofera tinctoria*, *Phyllanthus emblica*, *Sapindus mukorossi*, *Acacia Concinna* and *Eclipta alba* (L.) Hassk., *Coffea Arabica*, *Bacopa*

*monnieri*, *Nardostachys jatamansi*, *Hibiscus rosa-sinensis* and *Psidium guajava* L. A majority of people nowadays take extreme precautions to maintain health of their hair. For hair that is shiny, natural products having no negative consequences have been found. Almost seventy percent of people over fifty years of age battle the issue of hair loss and hair thinning. Popular Ayurveda plants have historically been applied for the

development of hair and colouring, including *phyllanthus emblica*, *Eclipta alba* (L) Hassk, *Lawsonia inermis*, *indigofera tinctoria*, *Nardostachys jatamansi*, *Sapindus mukorossi*, *Azadirachta indica* [2]. Until the development of chemical-free dyes, a variety of natural preparations were utilized across the world for the aim of colouring hair. *Lawsonia inermis* and *Indigofera tinctoria*, frequently referred to as the original textile colour, are commonly combined to produce a variety of lighter brown to black colours of human hair pigment [3]. The application of natural dye for the colouring of fabrics and food

components has been revitalized and examined in the current era of environmental protection [4-6].

#### MATERIALS & METHOD:

To develop a natural hair dye, we have chosen a variety of herbal components, including *Lawsonia inermis*, *Phyllanthus emblica*, *Sapindus mukorossi*, *Acacia concinna*, *Eclipta Alba* (L.) Hassk., *Coffea arabica*, *Bacopa monnieri*, *Nardostachys jatamansi*, *Hibiscus rosa-sinensis*, *Indigofera tinctoria*, *Psidium guajava*, *Azadirachta indica* etc.

A uniform combination of the components was taken to prepare a powdered form.

Table 1: Name & Quantity of Ingredients used to innovate natural hair dyes

Sr. No	Ingredients	Quantity [F <sub>1</sub> ]	Quantity [F <sub>2</sub> ]
1	<i>Lawsonia inermis</i>	20 gm.	10 gm.
2	<i>Phyllanthus emblica</i>	3 gm.	2 gm.
3	<i>Sapindus mukorossi</i>	2 gm.	-
4	<i>Acacia concinna</i>	1 gm.	1 gm.
5	<i>Eclipta alba</i> (L.) Hassk.	3 gm.	2 gm.
6	<i>Coffea Arabica</i>	1 gm.	1 gm.
7	<i>Bacopa monnieri</i>	2 gm.	1 gm.
8	<i>Nardostachys Jatamansi</i>	1 gm.	-
9	<i>Hibiscus rosa-sinensis</i>	2 gm.	-
10	<i>Indigofera tinctoria</i>	3 gm.	-
11	<i>Psidium guajava</i>	1 gm.	2 gm.
12	<i>Azadirachta indica</i>	1 gm.	1 gm.

#### Organoleptic evaluation:

**Colour of formulation:** It measures which colour is present in a prepared sample. We have checked the colour of prepared sample by dissolving it in distilled water.

**Odour of formulation:** The prepared sample gives pleasant odour.

**Texture:** The physical experience of the sample is smooth.

**Appearance:** It shows the external appearance of the sample.

Table 2: Organoleptic Evaluation of Innovated hair dye

Sr. No.	Parameters	F1	F2
1	Colour	Blackish Brown	Light Brown
2	Odour	Pleasant	Pleasant
3	Texture	Smooth	Smooth
4	Appearance	Powder	Powder

**Determination of pH:** The pH of hair dye was measured by using a pH meter by making suspension of 0.2 gm hair dye in 10 ml water & filtration of it. pH measured of filtrate. Formulation F1 shows 6.5 & F2 shows 7 pH. Both are biologically skin friendly pH.

**Phytochemical evaluation:**

**Molisch's Test:** 1gm of sample was mixed with 1ml of distilled water and 2 to 3 drops

of Molisch's reagent was added into it to determine the presence of carbohydrates.

**Volatile Oil Test:** 1gm of sample was added into alcoholic solution of Sudan to observe the presence of volatile oil.

**Mayer's Test [For alkaloid]:** 1gm of sample was added into Mayer's reagent which shows brown colour that indicates the presence of alkaloids.

Table 3: Phytochemical Evaluation of Innovated Hair dyes

Sr. No.	Parameters	Result [F1]	Result [F2]
1	Molisch's Test	Carbohydrates Present	Carbohydrate Present
2	Volatile oil Test	Volatile oils Absent	Volatile oil Absent
3	Mayer's Test	Alkaloids Present	Alkaloids Present

**Rheological evaluation:**

**Bulk density:** Take 5gm of powdered dye into a 100ml measuring cylinder after precisely weighing it. Level the powder mixture gently without compacting and measure the apparent unsettled value.

**Bulk density = Bulk mass/Bulk volume**

**Tapped density:** Take 5gm of powder dye should be correctly weighed and transferred into a 100ml measuring cylinder. Next precisely tap the chamber containing and measure tapped density. **Tapped density = Mass/ Tapped volume**

**%Carr's index:** Depending on tapped density (T) and bulk density (B), which are used to determine a powder's compressibility.

**%Carr's index = (Tapped density- bulk density) Tapped density \*100**

**Hausner's ratio:** the proportion between a powder's tapped and poured (loose) bulk densities.

**Hausner's ratio = Tapped density/Bulk density**

Table 4: Rheological evaluation of Innovated Hair dyes

Sr. no.	Parameters	Results of F1	Results of F2
1	Bulk density	0.49	0.47
2	Tapped density	0.52	0.49
3	%Carr's index	57%	48%
4	Hausner's ratio	1.6	1.4

**Determination of melting point:** The product is added to a glass capillary and the

temperature is noted while the substance is melted.

**Patch Test:** Hair dye applied for hair showing results of no allergic reaction.

**Table 5: Melting point of formulated Hair dyes**

Sr. No.	Sample	Melting Point
1	F <sub>1</sub>	160 °C
2	F <sub>2</sub>	140 °C

**Table 6: Patch Test of Formulated Hair dyes**

Sr. No.	Parameters	Results of F <sub>1</sub>	Results of F <sub>2</sub>
1	Swelling	Negative	Negative
2	Redness	Negative	Negative
3	Irritation	Negative	Negative

**Antibacterial Activity:** The antibacterial activity of the organisms was tested using organism cultures that had developed for twenty-four hours. To create the medium-sized nutrient agar plates, ninety centimetres of sterilized Petri dishes and fifteen to twenty millilitres of nutrient agar media. 0.1 per cent was administered before dishes were given a 5- to 10-minute hardening period after the inoculum. Agar discs with a diameter of 5 millimetres were produced by

the diffusion technique using agar discs and autoclaved with No. 1 Whatman filter paper or newsprint to sterilize them. The discs then received applications of various extracts from plants at various concentrations. A 24-hour incubation period at 37 degrees Celsius followed on the plates. The plates passed through after standing for thirty minutes. Antibacterial activity was assessed by calculating the width of the inhibiting zone in millimetres [7-8].

**Table 7: Antibacterial screening of Innovated hair dyes F1 & F2**

Antibacterial activity					
Name of sample	Conc. (µg/ml)	Microorganisms and zone of inhibition			
		Gram-positive bacteria		Gram-negative bacteria	
		<i>S. aureus</i>	<i>B. subtilis</i>	<i>E. coli</i>	<i>P. arginase</i>
F1	10	15mm	12mm	14mm	13mm
F2	10	15mm	11mm	18mm	13mm
Standard(penicillin)	10	17mm	12mm	16mm	12mm

**Table 8: Costing Of Hair Dye (In Indian Rupee)**

Sr. No.	INGREDIENTS	Cost /50 gm (INR)	QUANTITY Used in F1 (in gm)	Cost (INR)	QUANTITY Used in F2 (in gm)	Cost (INR)
1	<i>Lawsonia inermis</i>	85	20	34	10	17
2	<i>Phyllanthus emblica</i>	153	3	9.18	2	6.12
3	<i>Sapindus mukorossi</i>	80	2	3.2	-	-
4	<i>Acacia concinna</i>	128	1	2.56	1	2.56
5	<i>Eclipta prostrate</i>	99	3	5.94	2	3.96
6	<i>Coffea Arabica</i>	165	1	3.3	1	3.3
7	<i>Bacopa monnieri</i>	112	2	4.48	1	2.24
8	<i>Nardostachys Jatamansi</i>	145	1	2.9	-	-
9	<i>Hibiscus rosasinensis</i>	185	2	7.4	-	-
10	<i>Indigofera tinctoria</i>	129	3	7.74	-	-
11	<i>Psidium guajava</i>	125	1	2.5	2	5.00
12	<i>Azadirachta indica</i>	64	1	1.28	1	1.28
Total			40 gm	84.48 Rs	20 gm	41.46

Price of prepared sample F1 is 84.48 Rs / 40gm; Price of prepared sample F2 is 41.46 Rs/ 20 gm; We have observed that the prepared sample is less costly compare to market price.

**RESULT AND DISCUSSION:**

It is known that prepared herbal hair dye contains all-natural ingredients. We have used *Lawsonia inermis* and *Indigofera tinctoria* act as colouring agent. *Phyllanthus emblica* improves the absorption of calcium resulting in stronger hair and helps in new hair growth. *Phyllanthus emblica* contains the highest concentration of the antioxidants and also a good source of vitamin C. *Sapindus mukorossi* is a good source of mucilage, saponin, carbohydrates, fatty acids and vitamins A, D, E and K. *Acacia concinna* contains vitamin C that is good for hair. *Eclipta prostrata* a herb that has been employed to make a variety of oils, shampoos and hair colours. *Coffea genus* its shades of diverse colours ranging from radish brown to blackish brown. *Bacopa monnieri* gives strength to hair roots and keeps hair healthy. *Nardostachys jatamansi* helps to keep the natural colour of hair while promoting hair growth and preventing male pattern baldness. *Hibiscus rosa-sinensis* is naturally rich in calcium, phosphorus, iron, vitamin B1, vitamin C, riboflavin and niacin. This flower is used to treat dandruff and also slows down the premature greying of hair. *Psidium guajava L.* rich in vitamins B and C and also possesses anti-inflammatory, anti oxidant and anti microbial qualities that support healthy hair growth. *Murraya koenigii* contains beneficial antioxidants and vitamin B and

also contains nutrients that prevent the development of greying hair.

**CONCLUSION:**

A hair colour made of herbs has been prepared. It provides a viable natural alternative to synthetic hair dye. Natural hair packaging gives the hair a nearly vintage colour. Herbal-based cosmetics have the benefit of being harmless as our innovated hair dyes are showing promising results in patch test. Both formulations are showing skin friendly pH. Dandruff is treated by removing extra oil from the scalp. The naturally formulated hair packs with beneficial plant powders are ideal for hair maintenance. Natural remedies are becoming generally accepted because they are safer and have fewer adverse effects than solutions made of chemicals. Prepared sample gives good antibacterial activity against microbes. We have also observed that prepared sample is less costly compare to market price & has great commercial scope.

**REFERENCE:**

- [1] Natural colourants and dye In Pharmacognosy and phytochemistry. 1st Ed. 2004; 1: 98-117.
- [2] Ashok D, Vaidya B, Devasagayam T. Current status of herbal drugs in India: An overview. J Clin Biochem Nutr 2007; 41(1): 1-11.

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- [3] Khare CP. Indian herbal remedies: Rational Western therapy, Ayurvedic, and other traditional usage 2003; 89
- [4] Chaudhary G, *Lawsonia inermis* Linnaeus: A phytopharmacological review. Int J Pharm Sci Drug Res 2013; 2(2): 91-8.
- [5] Mac Dougall Color food Woodhead Publishing Ltd 1st Ed. 2002.
- [6] 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.
- [7] Runyoro D, Matee M, Olipa N, Joseph C, Mbwambo H. Screening of Tanzanian medicinal plants for anti-Candida activity. BMC Complement Altern Med. 6, 2006, 11.
- [8] S Priya Joy and Dr. D. Patric Raja, “Anti-Bacterial Activity Studies of *Jasminum grandiflorum* and *Jasminum sambac*”, Ethnobotanical Leaflets 12, 2008, 481.