Research Article

DESIGN AND INVITRO EVALUATION OF POLYHERBAL HAIR OIL

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A R T I C L E   I N F O

A B S T R A C T

Background: The main objective of the study is to develop a polyherbal hair oil formulation that can be used to prevent hair fall, gray hair, dandruff, baldness and dry hair.
Method: The developed formulations were subjected to evaluation. It includes phytochemical evaluation, organoleptic properties and physical parameters like pH, viscosity, specific gravity, refractive index, acid value and saponification value. The various herbal ingredients used in this present formulation are fruits of Emblica Officinalis, leaves of Lawsonia Inermis, Indigofera tinctoria, Eclipta Alba, Tridax procumbens, Ocimum tenuiflorum, gel of Aloe barbadensis, oil of Cymbopogon Citratus and cold pressed oil of Cocos Nucifera. The herbal hair oil formulations were prepared by boiling the contents in coconut oil at a temperature of 80   for 15 minutes.
Result: Out of the prepared 2%, 4% and 8% formulations, the 8% hair oil formulation is showing more color intensity and the same intensity is maintained even after three times shampooing.
Conclusion: The prepared formulations of polyherbal hair oil were reported to have properties like hair growth, prevents premature graying of hair, anti-dandruff, and moisturizing properties. Apart from phytochemical, organoleptic, physical properties, color stain intensity on hair is also measured.

INTRODUCTION

Many people in the world, both in developed and developing countries, are adopting herbal medicines to treat various diseases. Herbal products have been widely used by individuals as home remedies. With the invention of modern medicines, the use of herbal products has been down, but in recent times the use of herbal medicines has increased tremendously because they are safe, natural, non-toxic, easily available and compatible with all skin types when compared to synthetic products[1].Herbal plant ingredients found in gels, oils, face packs, tonics and creams have been shown to be more beneficial than synthetic formulations containing chemical components. Natural origin ingredients impart smoothness, luster to the hair, and help in treating various hair problems like hair fall, gray hair, dandruff, baldness, and dry hair.Herbal cosmetics help in enriching the body with various essential nutrients and minerals[2].

Hair is a vital, attractive and beautifying part of the body. Hair is a simple structure and is made up of a protein filament

keratin. It influences the appearance of people and also affects the self-esteem of both genders. Healthy hair is an indication of the overall wellbeing of a person[3]. Hair typically grows in three cyclic phases viz the anagen (growth) Phase, catagen (involution) phase and telogen (rest) phase. The anagen phase is a growth phase where rapid cell division occurs and the baby hair begins to grow. The anagen phase lasts for 2-6 years. The hair stops growing during the catagen phase, stands firm and does not fall out and lasts for 2-3 weeks. The mature hair falls off in the Telogen phase. This phase lasts for 2-3 months[4]. Generally, 50 to 100 hairs are shed every day and Hair fall is a condition where more than 100 hairs are shed every day[5]. During the anagen phase hair is more pigmented, that stops during the catagen phase and is absent during the telogen phase. In women, graying is seen in the frontal area and temporal area in men[6]. Dandruff is a fungal infection that is found in the scalp. It is characterized by the formation of flaky white to yellowish scales followed by extreme drying of the scalp, overactivity of the oil gland, itching and redness of the scalp[7]. Baldness is described as a pattern of loss of scalp hair in both men and women. It is characterized by thinning and loss of hair follicles in the early stage of hair fall, this is caused by stress, menopause, birth control medication, chemotherapeutic agents, hormonal imbalance and excessive use of hair styling products[8]. Dry hair is a condition that does

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not have normal shine and texture due to lack of adequate moisture and oil to the scalp. Dry hair is due to repeated shampooing of hair and recurrent hair styling[9]. Hair problems occur due to deficiency of vitamin B_6, B_{12}, D, E, biotin, minerals like iron, copper, calcium, zinc, hormonal imbalances, stress, environmental and genetic factors[10].

Though synthetic drugs like minoxidil and finasteride are used to treat hair fall and baldness, they have side effects like irritation of eyes, itching, redness and other hypersensitivity reactions. Minoxidil after 5 years of usage shows a decline in the regrowth of hair[11,12]. People rely on hair colorants for the restoration of hair colour, which is prepared either from natural

reactions. Minoxidil after 5 years of usage shows a decline in the regrowth of hair[11,12]. People rely on hair colorants for the restoration of hair colour, which is prepared either from natural or synthetic products.

Herbal hair packs are used to dye the hair to overcome the side effects caused by synthetic hair dyes like hypersensitive reactions. The natural hair dyes which are available in the market also contain 1-3% of phenylenediamine which is a synthetic hair dye component that stains the skin and clothes[13]. There is a demand to develop a product that includes only the plant constituents which are safe to use and does not have the difficulty of staining the skin during usage.

Table 1 List of ingredients, chemical constituents and their uses

S.No	Common name, Biological source, Family.	Chemical constituents	Uses	Image
1.	Aloe vera, Leaves of Aloe Barbadensis, Liliaceae.	Vitamins A, C, E (Antioxidants), Salicylic acid, Saponins, Amino acids.	Moisturizersoftens hair, prevents itching and reduces dandruff.	
2.	Amla, Fruits of Emblica Officinalis, Euphorbiaceae.	Gallic acid, Ellagic acid, Emblicanin A & B, Ascorbic acid, Quercetin, Iron and Calcium.	Treats the scalp ailments, Hair growth, Prevents premature graying of hair, Anti-dandruff agent.	
3.	Eclipta (False Daisy), Aerial parts of Eclipta Prostrata, Eclipta Alba, Asteraceae.	wedelolactone [1.6%],demethylwedelolactone, demethyl-wedelolactone-7 glucoside.	Hair growth stimulator, strengthens hair, Prevents graying of hair and dandruff.	
4.	Indigo, Leaves of Indigofera Tinctoria, Papilionaceae (Fabaceae).	Glycosides, Steroids, Tannins, Flavonoids, Quinones, Saponins, Phenols like gallic acid, Quercetin and myricetin, Indirubin.	Hair growth stimulator, Hair dye.	
5.	Henna, Leaves of Lawsonia Inermis, Lythraceae.	Lawson (2-hydroxynaphthoquinone), gallic acid, white resin, sugars, tannins and xanthones.	Treats gray hair, hair dye, improveshair growth, treats dandruff, strengthensand conditions the hair.	
6.	Tulsi, Leaves of Ocimum Tenuiflorum, Lamiaceae.	Oleanolic Acid, Ursolic acid, Rosmarinicacid, eugenol, Carvacrol,Linalool,beta caryophyllene.	Promotes hair growth, reducesdandruff, and decreases hair fall.	
7.	Tridax, Plant of Tridax proculens, Asteraceae.	Alkaloids,steroids, carotenoids, flavonoids (such as catechins, centaurein and bergenins), fatty acids, phytosterols, tannins and minerals.	Stimulates hair growth, dyeing of grey hair into black naturally.	
8.	Lemongrass, Cymbopogonflexuosus,Poaceae.	z-citral, borneol, estragole, methyleugenol.geranyl acetate (3,7-dimethyl-2,6-octadiene-1-ol acetate), geraniol, beta myrcene, limone, piperitone, citronellal, carene-2, alpha-terpineol.	Regrows hair by addressing scalp issues such as eczema, dandruff and psoriasis.	
9.	Coconut oil, Dried kernels of the Cocus Nucifera.Arecaceae	Lauric acid, Oleic acid, myristic acid, linoleic acid palmitic acid.	Hair moisturizer prevents a dry, flaky scalp, dandruff, split ends and hair breakage.	

Herbal hair care products are categorized into hair tonics and hair grooming aids[14,15]. Herbal hair oils are the hair care preparations that are used for preventing and treating various hair related disorders, it not only moisturizes but also reverse dry scalp and dry hair condition results in healthy hair and maintains normal functioning of sebaceous glands by providing essential minerals and nutrients required for growth of healthy hair, to stop and treat baldness, dandruff and aggression of hair[16,17,18].To avoid all the hair related problems, people have to apply many products for each condition. To avoid such problems, there is a need to develop a polyherbal hair oil formulation which will overcome the problem of using many natural and synthetic hair care products.

MATERIALS AND METHOD

Method

Collection of plant products
For the preparation of polyherbal hair oil formulation, various plant parts were collected, namely fruits of Emblica Officinalis, leaves of Lawsonia Inermis, Indigofera tinctoria, Eclipta Alba, Tridax procumbens, Ocimum tenuiflorum, gel of Aloe barbadensis, oil of Cymbopogon Citratus and cold pressed oil of Cocos Nucifera from the local market and authenticated by URBAN BOTANICS, Kompally, Hyderabad, Telangana.

Formulation of polyherbal hair oil

The collected plant parts are dried under the shade. Drying under the shade will retain the herb's active phytoconstituents. Hence, drying under shade is preferred compared to artificial drying. To convert dried parts of the plant into coarse powder a mixer was used. Later, all coarsely powdered drugs are passed through the sieve number 80. A uniform mixture is obtained by blending the coarse powder. Now, coconut oil is added to all three formulations having 2%, 4% and 8% powdered herbs and mixed well. The formulations containing 2%, 4% and 8% of powdered herbs were boiled in 100ml of coconut oil at the temperature of 80 for 15minutes. Allow the formulations to cool at room temperature and filter them. Then add two drops of lemongrass oil as perfume to these formulations. Now the volume was made up to 100ml using coconut oil for all three formulations. Then transfer these prepared 2%, 4% and 8% formulations of polyherbal hair oil into amber colored bottles.

Table 2 Ingredients used in the formulation of polyherbal hair oil.

Ingredients	Quantity		
	2%	**4%**	**8%**
Aloevera	2gm	4gm	8gm
Amla	2gm	4gm	8gm
Eclipta	2gm	4gm	8gm
Indigo	2gm	4gm	8gm
Henna	2gm	4gm	8gm
Tulsi	2gm	4gm	8gm
Tridax	2gm	4gm	8gm
Lemongrass oil	2 drops	2 drops	2 drops
Coconut oil	q.s 100ml	q.s 100ml	q.s 100ml

Figure 1 Filtration of herbal hair oil

Figure 2 Formulation of herbal hair oil

Evaluation of polyherbal oil

The prepared herbal hair oils are subjected to phytochemical evaluation, organoleptic evaluation and physical evaluation.

Phytochemical evaluation of polyherbal hair oils: Various plant constituents were identified by subjecting the prepared hair oils to qualitative chemical analysis.

Table 3 Qualitative tests for phytochemical screening

Name of the constituent	Test	Reagent
1.Carbohydrates	Molisch's test	A solution of naphthol in ethanol + Concentrated sulphuric acid.
2.Alkaloids	Fehling's test	Solution-A: Copper sulphate Solution-B: Potassium sodium tartrate.
	Dragendorff test Hager's test	Potassium bismuth iodide. Saturated aqueous solution of picric acid.
3. Glycosides	Bontrager's test	
4.Proteins	Biuret test	Sulphuric acid + chloroform dilute ammonia.
5.Saponins	Saponin test	Sodium hydroxide and hydrated copper sulphate together with potassium sodium tartrate.
6. Flavonoids	Shinoda test	Water + herbal oil gives the foam.
7.Tannins	Ferric chloride test	Magnesium turnings + concentrated Hcl.
8. Phytosterols	Liebermann Burchard test	Ferric chloride.
9.Volatile oils	Volatile oils test	Acetic anhydride + concentrated Sulphuric acid.
		Sudan III solution or Tincture of alkane.

Organoleptic evaluation

The macroscopic characters such as colour, odour, and texture of the herbal hair oil can be determined using sensory organs like eyes and nose.

Physical evaluation

pH

pH of polyherbal hair oils is measured using a digital pH meter. All herbal oil formulations were taken in a beaker and dip the pH electrode in the beakers and wait for one minute till we get a constant reading without fluctuations. Now, note down the readings. Before using the pH meter, it must be calibrated using pH 7 buffer and pH 4 buffer[19].

Viscosity

Viscosity is determined by using Brookfield's viscometer. The oils were taken in a small sample adapter, fixed to the viscometer and the temperature is maintained at 25 ± 0.2 for viscosity determination. Start the viscometer and wait for a minute to get a constant reading and the viscosity was noted in centipoise[20].

Specific gravity

Take the pycnometer, rinse it with distilled water and dry it, take the weight of the empty pycnometer(W_1), then take the weight of the pycnometer with oils (W_2). The weight of the oils is determined by using the formula[21].

weight of the sample = $W_2 - W_1$

Refractive index

The refractive indices of all herbal hair oil formulations were determined by using the Refractometer.

Acid value

Preparation of 0.1 molar solution: Weigh 0.56g of potassium hydroxide pellets and dissolve in distilled water with continuous stirring. The prepared 0.1 molar potassium hydroxide solution was filled in the burette.

Preparation of sample: Measure 10ml of each oil and dissolve in 25ml of ether mixture and shake it continuously. Add 1 ml of phenolphthalein solution as an indicator and titrate it against 0.1 molar potassium hydroxide solution. The acid value of the prepared oils was calculated by using formula[22].

Acid value = 5.61 n/w
where n → Volume of 0.1 molar potassium hydroxide solution consumed.
w → weight of oil.

Saponification value

2g of oils were accurately weighed and transferred into a 250 ml of iodine flask each, 25 ml of 0.5 M of alcoholic potassium hydroxide solution was added to all three formulations and boiled under reflux in a water bath for 30 minutes. Few drops of phenolphthalein were added as an indicator in each formulation and titrated against 0.5 M hydrochloric acid (a) Similarly, the blank was performed without the samples (b). The saponification value of the prepared oils was calculated by using the formula [23].

Saponification value= 28.05(b-a)/w
where w → weight in a gram of the solution

Colour intensity

The prepared herbal hair oil was tested on white hair for colour intensity property. The human white hair was collected from the barber shop and is used for testing the colour intensity property of the hair. The different percentages of hair oils 2%, 4%, 8% is applied to the white hair and after 1 hour they are observed for the colouring property of the hair. After that the hair was washed with shampoo and observed for the colour of the hair.

RESULTS AND DISCUSSION

The prepared herbal hair oil is used to treat various hair related ailments like hair fall, gray hair, dandruff, baldness and dry hair. The herbal hair oil contains Aloe vera, Amla, Eclipta, Indigo, Henna, Tulsi, Tridax, Lemongrass oil and Coconut oil. Which have a special role in the formulations such as Hair growth, prevents premature graying, anti-dandruff and moisturizes the hair. The various parameters evaluated are phytochemical constituents, organoleptic properties and physical parameters like pH, viscosity, specific gravity, refractive index, acid value and saponification value are summarized **Table 3 and 4.**

Table 4 Evaluation of Phytochemical constituents.

Constituents	Aloe vera	Amla	Eclipta	Indigo	Henna	Tulsi	Tridax
Carbohydrate						+	
Alkaloids	+		+				+
Glycosides		+	+	+	+	+	
Proteins	+						
Saponins	+		+	+	+		
Flavonoids				+	+	+	+
Tannins		+		+		+	+
Phytosterols				+	+		+
Volatile oils			+			+	

Table 5 Evaluation of organoleptic properties and physical parameters.

| Organoleptic/ Physical parameters	2%	4%	8%
Colour	Dark green	Dark green	Dark green
Odour	Characteristic	Characteristic	Characteristic
pH	6.97 ± 0.08	6.97 ± 0.02	6.98 ± 0.12
Viscosity (Centipoise)	55 ± 0.03	59 ± 0.07	63 ± 0.09
Specific gravity (g/cm³)	0.898 ± 0.01	0.921 ± 0.02	0.933 ± 0.03
Refractive index	1.43 ± 0.1	1.54 ± 0.01	1.62 ± 0.09
Acid value	2.43 ± 0.29	2.17 ± 0.03	1.86 ± 0.28
Saponification value	196 ± 0.78	213 ± 0.9	258 ± 0.54
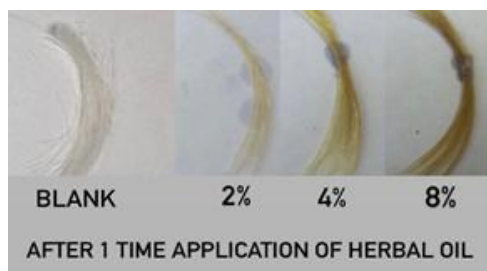
Figure 3 After one time application herbalhair oil
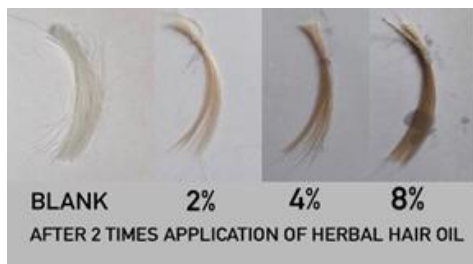

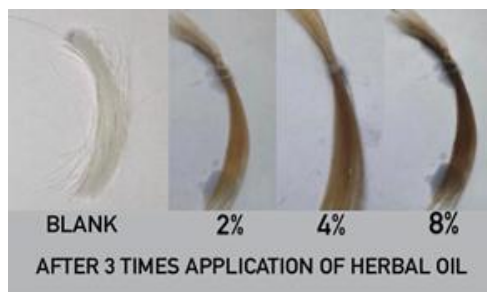**Figure 4** After two times applicationof of herbal hair oil

Figure 5 After three times application of herbal hair oil

Figure 6 After one-timeshampooing hair.

Figure 7 After two times shampooing of hair.of

Figure 8 After three times shampooing of hair.

The different percentages of hair oils 2%, 4%, 8% is applied to the white hair and after 1 hour observed for the colouring property of the hair. Later the coloured hair was washed with the shampoo and observed for the colour intensity of the hair for all three formulations. **Figure 3,4 and 5** depicts successive application of the herbal hair oils on white hair. From these figures we concluded that 8% formulation of herbal hair oil showed more colour intensity when compared to 2% and 4% formulations respectively. It is also concluded that three time application of hair oil is showing more colour intensity than second and first time application. **Figure 6,7 and 8** depicts successive shampooing of hair after herbal hair oils application on white hair. From these it is concluded that 8% hair oil formulation is showing more colour intensity and the same intensity is maintained even after three times shampooing of hair. Hence, the formulated herbal hair oils have hair growth, prevent graying of hair, anti dandruff and moisturizing properties. All the parameters were evaluated for 2%, 4% and 8% hair oil formulations and they are within the acceptable limits. The formulations were applied on white hair, out of three formulations, the 8% herbal hair oil formulation has shown higher colour intensity upon application and also maintains the same colour intensity even after three times shampooing of hair compared to 2% and 4% formulations. Therefore, 8% herbal hair oil formulation was proven to be the best formulation.

CONCLUSION

Polyherbal hair oil is one of the most efficient and well known hair treatments. Herbal ingredients and phytoconstituents used for the formulation of polyherbal hair oil were reported to have good properties like hair growth, prevents premature graying of hair, anti dandruff and moisturization. Therefore, the herbal hair oil is very important in treatment of various hair ailments and the prepared hair oil is possessing minimal or no side effects.

Conflict of Interest

The authors reveals that there is no conflict of interest.

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