IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Formulation And Evaluation Of Herbal Hair Dye Using Coconut Coir

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ABSTRACT

Conventional hair dyes often contain chemicals such as ammonia, parabens, and para-phenylenediamine (PPD), which may lead scalp irritation , hair damage, and pose long term health risks. With the growing Consumers demand for a safer options, herbal based hair dyes have emerged as a promising alternative. This study presents the development of an herbal hair dye that combines safety with effective performance. The composition contain plant based ingredients identified for their versatile function providing coloration strengthening hair texture preventing hair fall ,,hair loss promoting scalp health. Selected herbal ingredients include coconut coir, almond powder, amla, indigo powder, henna powder, coffee powder, reetha, shikakai, and baheda. The formulation was evaluated for organoleptic, physicochemical, phytochemical, rheological properties, efficacy, and shelf life. The final product exhibited excellent colour intensity ,adherence ,longevity and sterility, suggesting its potential as a safer alternative to synthetic hair dyes.

Keywords: herbal hair dye, henna, indigo, natural colorants, cosmetic formulation

1. Introduction

As compared to the chemical-based hair dyes, which cause skin related diseases, natural herbal dyes are being preferred nowadays. 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. Synthetic hair dyes provide vibrant color but often contain harsh chemicals such as PPD, ammonia, and parabens that can lead to allergic reactions, scalp irritation, hair shaft damage, and even carcinogenic effects with prolonged use [6,17]. There is an increasing consumer demand for natural and safer cosmetic alternatives that minimize health risks without compromising performance. The dye was prepared based on experiences of various people who were using different plant products for coloration purposes on their hair without any

problems of irritancy, allergy or sensitivity. In this modern science, the need of herbal based natural medicines is increasing vastly due to their natural goodness and lack of side effects.

Traditional herbal dyes, derived from plants like henna (Lawsonia inermis), indigo (Indigofera tinctoria), and amla (Phyllanthus emblica), have been used for centuries to impart color and nourish hair. These plants not only color hair but also condition the scalp and reduce hair fall, providing multifaceted benefits [4,7,12,15]. However, herbal hair dyes sometimes suffer from issues like limited color range, poor fixation, or slow application.

This study aimed to develop a novel herbal hair dye formulation that offers natural black coloration with improved texture, color fastness, and safety profile. The formulation includes synergistic herbal powders selected for their coloring and hair conditioning properties, intended to serve as a safer alternative to synthetic dyes.

Figure No 1. Allergic Reactions due to synthetic hair dyes

2. Role of Ingredients Used in The Formulation

coconut coir, almond powder, amla, indigo powder, henna powder, coffee powder, reetha, shikakai, and baheda.

2.1 Coconut Coir (coconut shell ash**)**

1. Scalp Cleansing & Detox: [27]

Burnt coconut derivatives like **activated charcoal** or **coconut shell ash** act as deep cleansers. Their porous structure absorbs excess oil, product build up, impurities, and dandruff, leaving the scalp refreshed—a healthier foundation for hair growth.

2. Stimulates Follicles & Hair Growth [28]

By detoxifying and gently exfoliating the scalp, these ingredients unclog hair follicles, improve blood circulation, and create a more conducive environment for hair growth.

3. Strengthens & Balances Scalp [29]

Coconut shell ash contains minerals like potassium and magnesium that may strengthen hair strands, reduce brittleness, and help balance scalp pH.

4. Adds Volume & Reduces Dandruff [30]

After deep cleansing, hair often appears fuller and more voluminous. Additionally, the oil-absorbing properties can help reduce flakiness and scalp itchiness.

2.1. Henna

Its principle coloring ingredient of is lawsone, a red orange color compound present in dried leaves of the plant in a concentration of 1 1.5% w/w. Lawsone acts as a non oxidizing hair coloring agent at a maximum concentration of 1.5% in the hair dyeing product. Other constituents in henna such as flavonoids and gallic acid act as organic mordants to the process of colouring. Carbohydrates give the henna paste a suitable consistency for adherence to the hair [31, 32]. Natural henna is usually hypoallergenic but allergic reactions occurred in mixed types including black henna. This occurs due to chemical compounds consisting of para-phenylenediamine¸ 2-nitro-4- phenylenediamine¸ 4-aminophenol and 3-aminophenol [233]. Henna has also antifungal activity against Malassezia species (causative organism of dandruff). Henna prevents premature hair fall by balancing the pH of the scalp and graying of hair. Henna leaf paste used for alleviating Jaundice, Skin diseases¸ Smallpox¸ *etc*. Extract of Henna leaves with ethanol (70%) showed significant hypoglycaemic and hypolipidaemic activities in diabetic mice [34, 35].

2.2. Amla

Berries obtained from amla enhances the absorption of calcium, helping to make healthier bones, teeth, nails, and hair. It maintains the hair color and prevents premature graying, strengthens the hair follicles [36]. Amla is the mostly rich and concentrated form of Vitamin C along with tannins found among the plants. Whole fruit is used as an active ingredient of the hair care preparations. The Vitamin C found in the fruit binds with tannins that protect it from being lost by heat or light [37, 38]. This fruit is also rich in tannins, minerals such as Calcium, Phosphorus, Fe and amino acid. The fruit extract is useful for hair growth and reduce hair loss [39]. Amla has antibacterial and antioxidant properties that can help promote the growth of healthy and lustrous hair [40].

2.3. Reetha

Its fruit is rich in vitamin A, D, E, K, saponin, sugars¸ fatty acids and mucilage. Reetha extract is useful for the promotion of hair growth and reduced dandruff [4]. Extract of fruit coat acts as a natural shampoo, therefore is used in herbal shampoos in the form of hair cleanser [42]. Reetha as soapnuts or washing nuts, play an important role as natural hair care products since older times. This plant is enriched with saponins, which makes the hair healthy, shiny, and lustrous when used on regular basis [43].

2.4. Shikakai

It contains Lupeol, Spinasterol, Lactone, Hexacosanol, Spinasterone, Calyctomine, Racimase-A Oleanolic acid, Lupenone, Betulin, Betulinic acid, Betulonic acid. The extract obtained from its pods is used as a hair cleanser and for the control of dandruff [44]. Shikakai or acacia concinna, has rich amount of vitamin C, which is beneficial for hair. Shikakai naturally lowers the pH value and retains the natural oils of the hair and keeps them lustrous and healthy. It is also effective in strengthening and conditioning hair.Amla, reetha and shikakai compliments each other, therefore, they are mixed together to have healthy and lustrous hair. All of these ingredients come in two forms, one as a dried fruit and other in powdered form. Amla, Reetha and Shikakai suit all hair types and help prevent split ends, hair fall, dandruff, greying of hair and other hair related problems, to make hair soft and silky [45].

2.5. Coffee

In hair colorants, herbs can be used in the form of powder [46], aqueous extract [47]or their seed oil to impart shades of different colour varying from reddish brown to blackish brown [48]. The herbal drugs like coffee powder [49,50] obtained from its seeds are used as hair colorants [51,52].

2. Materials and Methods

2.1 Collection and Authentication of Crude Drugs

Herbal ingredients were collected from authenticated suppliers and identified based on pharmacognostic characteristics [10].

- Amla powder was prepared from ripe dried fruits.
- Almond powder obtained from dried almonds.
- Coconut coir processed from mature coconut husks.
- Indigo powder extracted from dried Indigofera tinctoria leaves.
- Henna powder prepared from dried Lawsonia inermis leaves.
- Baheda, reetha, shikakai, and coffee powders were sourced and authenticated similarly.

Ingredients	Image	Role
Coconut Coir		The coir is amazing for soothing your hair scalp and providing relief against mild irritation. It clean the scalp toughly.
Almond Powder		1) Almond oil is an emollient. 2) Rich source of vitamine E 3) Prevent graying of hairs
Coffee Powder		1) Coffee as colorant helps to dye hair or darken hair color naturally 2) It is darker in color so act as stain on hair

Henna Powder		1) This give the hair a natural looking red tone 2) Enhance hair color 3) Balance pH and oil production.
Reetha		1) Natural mild soap. 2) Control hairfall by removing dandruff. 3) Impart shine.
Shikakai		1) Shikakai has rich content Saponins. 2) This is naturally foaming agent gently cleanses the scalp. 3) It as prevent hair color from fading quickly.
Indigo Powder		1) A natural hair dye. 2) The indigo powder can be used to replace artificial hair dyes. 3) The plant based indigo does not contain harmful chemicals like ammonia and peroxide.
Amla Powder		1) Amla powder can raise the levels of sebum production, which can help get rid of dandruff. 2) Also prevent greying of hairs.

Baheda Powder		1) Help strengthen hair, promote hair growth and potentially impart a natural black color. 2) It soothes and hydrate the scalp, reducing dryness and irritation.

2.2 Preparation of Herbal Hair Dye

Ingredients were sieved through #22 mesh to ensure uniform particle size. Quantities were accurately weighed and thoroughly blended with mortar and pestle to obtain a homogeneous mixture. The powder was stored in airtight, moisture-proof containers to maintain stability [7,11].

2.3 Formulation Compositions

Ingredients	Formula 1 (g)	Formula 2 (g)	Formula 3 (g)
Coconut coir	4.0	3.0	2.0
Almond powder	0.5	0.5	0.5
Indigo powder	1.5	-	1.5
Amla powder	1.5	1.5	1.5
Coffee powder	1.0	1.0	1.0
Henna powder	-	2.0	1.5
Baheda powder	0.5	0.5	0.5
Reetha powder	0.5	0.5	0.5
Shikakai powder	0.5	0.5	0.5

Table 1: Formulation Compositions

3. Evaluation of the Herbal Hair Dye

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

3.1 Organoleptic Evaluation

Organoleptic characteristics for various sensory characters like color, taste, odour *etc*. was carefully noted down [21,22]. as illustrated in Table **2** The raw drugs and powders were separately studied by organoleptic and morphological characters like colour, odour, texture and appearance.

Parameter	Formula 1	Formula 2	Formula 3
Color	Dark brown	Greenish	Dark to olive green
Odor	Pungent	Characteristic	Characteristic
Texture	Fine	Lump formation	Fine
Appearance	Powder	Powder	Powder
Color on application	Green to grey	Light brown	Brown to dark brown

Table 2: Organoleptic evaluation of the formulations.

Inference: Formula 3 showed the best overall sensory characteristics and was selected for further testing.

3.2 Physicochemical 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. Table 3 reflects the above findings.

Test	Observation	Inference
pH	5.2	matches the natural pH of the scalp and hair
Loss on drying	2.5%	moderate moisture content
Total ash value	16.8%	moderate amount of inorganic constituents
extractive value	45% w/v	water as the optimal solvent.
Microscopic Examination	Hair strands treated with the herbal dye	showed intact cuticles without damage.

Table 3: Physicochemical Evaluation

3.3 Phytochemical Screening

Prepared herbal hair dye was subjected to Phytochemical screening to reveal the presence or absence of various phytoconstituents as Carbohydrates, Lipids, Alkaloids, Sugars *etc*. The formulation when dissolved individually in 5 ml of water and filtered; the filtrates were used to test the presence of carbohydrates [23]. The aqueous extract of the formulated herbal face pack was evaluated for the presence or absence of different Phytoconstituents as per the standard procedures and norms [24]. The results of phytochemical screening are highlighted in Table 4.

Test	Observation		Inference
Foam test	Foam formation	present	Saponins present
Fehling's test	Red precipitate	present	Carbohydrates absent
Molisch's test	Violet ring	present	Carbohydrates present
Hager's test	Yellow precipitate	present	Alkaloids present
Volatile oil test	Oily spots on paper	present	Volatile oils present

Table 4: Phytochemical screening results

3.4 Rheological Evaluation

Physical parameters like untapped or bulk density, tapped density, the angle of repose, Hausner's ratio, and carr's index were observed and calculated for the inhouse formulation. Bulk density symbolizes the adjustment of particles or granules collectively in the packed form. The formula for determination of bulk Density (D) is D = M/ V where M is the mass of particles and V the total volume occupied by them. This is determined by taking graduated cylinder. 100 grams of weighed formulation was added to the cylinder with the help of a funnel. The initial volume was noted and the sample was then tapped fully. The bulk density value was obtained from the initial volume and after tapping the volume noticed, from which tapped density was calculated. The angle of repose quantifies the flow properties of powder as it affects cohesion among the different particles. The fixed funnel cone method employs the calculation of Height (H) above the paper that is placed on a flat surface. The pack was carefully poured through the funnel till the formation of the peak. Here, R denotes the radius of the conical heap, tan a = H/R or a = arc tan H/R, where 'a' is the angle of repose. Hausner's ratio is linked with the interparticle friction and influences the powder flow properties. The Hausner's ratio is calculated as D /D' where D' is the tapped density and D, the bulk density. Carr's index helps to measure powder flow from bulk density [25,26] as shown in Table **5**.

Rheological evaluation of herbal dye.

Parameter	Result	**Inference**
Bulk density	0.32 g/mL	light and loosely packed powder
Tap density	0.41 g/mL	moderate compressibility and cohesive properties
Angle of repose	28°	Good flow property
Carr's index	18%	Fair flow property
Hausner's ratio	1.24	**Good** flowability

Table 5: Rheological evaluation of herbal dye.

3.5 Patch Test

This usually involves dabbing a small amount of the aqueous solution of hair dye behind the ear or on inner elbow in an area of 1sq.cm and leaving it to dry. Signs of irritation or feeing of non wellness is noted, if any. Measured and small quantities of prepared hair pack were applied to the specified area for a fixed time. Irritancy, redness, and swelling were checked and noticed for regular intervals up to 24 hours if any [620]. The results of tests for the signs of irritation are displayed in Table 6.

S.No	**Parameters**	**Result**
1.	Swelling	Negative
2.	Redness	Negative
3.	Irritation	Negative

Table 6: Rheological Properties

3.5 Stability Study

Stability testing of the prepared formulation was performed by storing it at different temperature conditions for the time period of one month. The packed glass *via*ls of formulation were stored at different temperature conditions *viz*., room temperature and 35℃ and were evaluated for the physical parameters like colour, odour, pH, texture, and smoothness as highlighted in Table 7 [19].

Parameter	Room Temperature	35℃
Color	No change	No change
Odor	No change	No change
pH	5.2	5.3
Texture	Fine	Fine
Smoothness	Smooth	Smooth

Table 7: Stability study

4. Result and Discussion

The formulated herbal hair dye, composed of **coconut coir, almond powder, amla, indigo powder, henna powder, coffee powder, reetha, shikakai, and baheda**, demonstrates a powerful and synergistic blend of natural ingredients aimed at delivering both **safe and effective hair coloring** and **therapeutic hair care benefits**.

Henna and **indigo powder** serve as the primary natural colorants, offering rich and long-lasting hair dyeing effects without the harmful side effects associated with synthetic dyes. **Coffee powder** enhances the depth and shine of the color, while also improving hair texture.

Amla, **baheda**, and **reetha** contribute to strengthening hair roots, preventing premature greying, and reducing dandruff due to their high antioxidant and antimicrobial content. **Shikakai** functions as a natural cleanser, maintaining scalp hygiene and promoting hair growth.

Almond powder adds nourishment and softness through its vitamin E and healthy fat content, supporting overall hair health and moisture retention. **Coconut coir**, often underutilized, plays a vital role in maintaining the structural integrity of the formulation, while also helping in mild exfoliation of the scalp and improving overall texture of the pack.

The stability of the formulation, along with the absence of synthetic additives, preservatives, and irritants, further ensures **its safety, longevity, and compatibility** with all hair and scalp types. Regular use of this herbal dye not only imparts natural, vibrant color but also promotes **healthier, shinier, and more voluminous hair** over time, offering a holistic and sustainable solution for hair care.

Organoleptic evaluation indicated the product is a smooth, pleasant-smelling powder. **Physicochemical analysis** showed a low moisture content of 2.5%, and a neutral pH, making it suitable for various scalp types. The **ash value** was within acceptable limits, confirming the presence of essential inorganic elements. The presence of key **phytoconstituents** in the herbs highlights the formula's nourishing qualities for both scalp and hair.

The **irritancy test** showed no signs of irritation, redness, or swelling, indicating good compatibility with hair proteins due to the absence of synthetic additives.

Stability testing conducted over a month under various temperature conditions demonstrated no significant changes in color, odor, texture, appearance, or pH, confirming the product's **stability**. As the formulation comprises dried herbal ingredients without moisture-laden substances, the risk of degradation is minimal.

The product was monitored for changes at room temperature over one month, and results confirmed **no alteration** in physical or chemical properties, ensuring it is **shelf-stable** and suitable for use in different environments.

Being a purely **natural, herbal-based formulation**, it avoids the adverse effects typically associated with ammonia-based chemical dyes. With **regular use**, it delivers healthy volume, smoothness, and vibrant color to the hair. Continued application enhances results over time. Free from **toxins, synthetic preservatives, artificial colors, or fragrances**, the formulation offers **long shelf life** and ingredient stability due to its clean, chemical-free composition.

The developed herbal hair dye demonstrated excellent compatibility, safety, and efficacy. The synergistic combination of natural colorants and hair-conditioning agents like amla and shikakai not only provided desirable black coloration but also improved hair texture and scalp health. Absence of synthetic chemicals reduced the risk of adverse effects commonly seen with conventional dyes.

Future studies should focus on broadening the color spectrum using other plant-based dyes and conducting clinical trials to evaluate long-term safety and consumer acceptance.

5. Conclusion

This study successfully developed a novel herbal hair dye that provides a safe, natural, and effective alternative to synthetic dyes. It demonstrates strong potential to meet the increasing consumer demand for eco-friendly and health-conscious cosmetic products.

6. Acknowledgement

I would like to express my sincere thanks to Mr. Dr shweta Ghode for her steady guidance and practical suggestions throughout the course of the project. I am also thankful to the pharmacognosy department for providing the workspace and basic support needed for the experimental work. I appreciate the cooperation of my teammate during the entire study.

6. References

1. Natural colorants and dye in: Pharmacognosy and phytochemistry. First edition India career publication; 2004. p. 98–117.
2. Kumar S, Akhila A, Naqvi AA, Farooqi AH, Singh AK, Uniyal GC, et al. Medicinal plants in skin care. Lucknow, India: CIMAP; 1994. p. 425–30.
3. Prabhu KH. Plant based natural dyes and mordant. Int J Chem Tech Res. 2012;4(2):649.
4. Ashok D, Vaidya B, Devasagayam T. Current status of herbal drugs in India: An overview. J Clin Biochem Nutr. 2007;41(1):1–11.
5. Khare CP. Indian herbal remedies: Rational western therapy, ayurvedic and other traditional usage. Botany. Springer; 2003. p. 89.
6. Harrison S, Sinclair R. Hair coloring, permanent styling and hair structure. J Cosmet Dermatol. 2004;3(4):180–5.
7. Bansal H, Sidhu MC, Goyal S. Formulation and evaluation of herbal hair dye. Int J Res Ayurveda Pharm. 2016;7(2):102–7. https://doi.org/10.7897/2277-4343.07235.
8. Shinde PR, Yadav AV. Natural hair dyeing potential of some common plants of India: A review. Res J Top Cosmet Sci. 2011;2(1):39–44.
9. Singh R, Kapoor V. Herbal cosmetics: Trends in skin and hair care formulations. Int J Pharm Sci Res. 2015;6(10):4034–40. https://doi.org/10.13040/IJPSR.0975-8232.6(10).4034-40.
10. Pandey A, Tripathi S. Concept of standardization, extraction and pre phytochemical screening strategies for herbal drug. J Pharmacogn Phytochem. 2014;2(5):115–9.

11. Lall N, Kishore N. Are plants used for skin care in South Africa fully explored? J Ethnopharmacol. 2014;153(1):61–84. https://doi.org/10.1016/j.jep.2014.02.007.
12. Dweck AC. Herbal medicine for the skin: Natural products for the skin and hair. Clin Dermatol. 2002;20(6):713–8. https://doi.org/10.1016/S0738-081X(02)00265-0.
13. Rout SP, Choudary KA, Kar DM, Das L, Jain A. Plants in traditional medicinal system—Future source of new drugs. Int J Pharm Sci Res. 2009;1(1):1–23.
14. Sultana B, Anwar F, Ashraf M. Effect of extraction solvent/technique on the antioxidant activity of selected medicinal plant extracts. Molecules. 2009;14(6):2167–80. https://doi.org/10.3390/molecules14062167.
15. Vats M, Mishra S. Phytochemistry and pharmacological activities of henna (Lawsonia inermis): A review. Int J Green Pharm. 2021;15(1):22–30. https://doi.org/10.22377/ijgp.v15i1.3763.
16. Lal B, Singh S. Comparative study of synthetic and herbal hair dyes. Int J Curr Pharm Res. 2019;11(6):28–31.
17. Bernhardt T, et al. Toxicological assessment of hair dyes: What is the toxicological basis for concern? Arch Toxicol. 2006;80(9):593–9. https://doi.org/10.1007/s00204-006-0090-1.
18. Singh A, Singh D, Bhat TK. Potential therapeutic applications of some antinutritional plant secondary metabolites. J Agric Food Chem. 2003;51(19):5579–97. https://doi.org/10.1021/jf030072s.
19. Rani S, Hiremanth R. Formulation & evaluation of poly-herbal face wash gel. World J Pharm Pharm Sci 2015; 4(6): 585-8.
20. Mandeep S, Shalini S, Sukhbir LK, Ram KS, Rajendra J. Preparation and evaluation of herbal cosmetic cream. Pharmacologyonline 2011; 1258-64.
21. Wallis TE. Text book of Pharmacognosy 5th Ed.. 2002; 123(132): 210-5.
22. Tandon N, Sharma M. Quality standards of indian medicinal plants. New Delhi. Indian Council of Medical Research 2010; 8: 161-3.
23. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy 42nd ed.. 2008; 6: 1-A1.
24. Khandelwal KR. Practical pharmacognosy 12th ed. 2004
25. Lachman L, Lieberman HA, Kanig JL. The Theory and practice of industrial pharmacy 3rd ed. 1987.
26. Aulton ME. 2002
27. How to reap the benefits of activated charcoal for your hair | BeBeautiful
28. 3 Powerful Benefits of Coconut Shell Charcoal Uses for Hair!
29. Coconut Shell Ash for Hair | Benefits and How to Use - DIYr
30. Activated Charcoal For Hair – Benefits And How To Use it
31. Patel MM, Solanki BR, Gurav NC, Patel PH, Verma SS. Method development for Lawsone estimation in Trichup herbal hair powder by high-performance thin layer chromatography. J Adv Pharm Technol Res 2013; 4(3): 160-5.
32. S.G. Design And Evalution Of Herbal Hair Oil Formulations By Using Ethanolic Extract Of Ziziphus Jujuba Mill. Leaves Int J Pharma Bio Sci 2017; 8(3): 322-7.
33. Saif FA. Henna beyond skin arts: Literatures review. J Pak Assoc Dermatol 2016; 26(1): 58-65.
34. Grabley S, Thiericke R. Bioactive agents from natural sources: Trends in discovery and application. Adv Biochem Eng Biotechnol 1999; 64: 101-54.
35. Chaudhary G¸. Lawsonia inermis Linnaeus: A phytopharmacological review. Int J Pharm Sci Drug Res 2013; 2(2): 91-8.
36. Singh E, Sharma S, Pareek A, Dwivedi J, Yadav S, Sharma S. Phytochemistry, traditional uses and cancer chemopreventive activity of amla (Phyllanthus emblica): The sustainer. J Appl Pharm Sci 2011; 2: 176-83.
37. Nisha P, Singhal RS, Pandit AB. A study on degradation kinetics of ascorbic acid in amla (Phyllanthus emblica L.) during cooking. Int J Food Sci Nutr 2004; 55(5): 415-22.
38. Gopalan C, Sastri BV, Balasubramaniam SC. Nutritive value of indian foods 1991.
39. Dahanukar S, Thatte U. Ayurveda Revisited 3rd ed. 2000.
40. Turner DM. Natural product source material use in the pharmaceutical industry: The Glaxo experience. J Ethnopharmacol 1996; 51(1-3): 39-43.
41. Anjali J¸. Hair care formulations. World J Pharm Pharm Sci 2016; 5(6): 630-48.

42. Fatima A¸. Int J Pharm Sci Res 2013; 4(10): 3746-60.
43. Wonderful benefits and uses Of soapnuts (Reetha). Home, health and wellness, ingredients and uses.
44. Fatima A, Alok S, Agarwal P, Singh P, Verma A. Benefits of herbal extracts in cosmetics: A review. Int J Pharm Sci Res 2013; 4(10): 3746-60.
45. Haircare: Include amla, reetha and Shikakai for healthy and happy hair. NDTV FOOD. Anusha Singh updated: May 10, 2018 Available from: https://food.ndtv.com/beauty/haircare-include-amla-reetha-and-shikakai-for-healthy-and-happy-hair-1848507
46. Upadhyay VP, Mishra AK. Workshop on selected medicinal plants. 1985. In: Ministry of Commerce, Chemexcil; Bombay. 1985.
47. Upadhyay VP. Current research in ayurvedic medicine (International Seminar). 1980. In: Himalayan Institute; Chicago, USA. 1980.
48. Upadhyay VP. International Seminar on Medicinal Plants. Plants as cosmetics 1985. In: Mungpoo, Govt. of West Bengal: Publication and Information Directorate, CSIR,; New Delhi. 1985.
49. Wealth of India. Raw materials. Anonymus 1997; 1
50. Kitrikar K, Basu BD. Indian Medicinal Plants 2nd ed. 1993; Vol. I: 335-6.
51. Chopra RN, Nayar SL, Chopra IC. Glossary of indian medicinal plant 1956.
52. Ambasta ST. Useful plants of india 1986.