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Formulation and Evaluation of Poly Herbal Anti-Dandruff Liquid Shampoo

Aruna.A*, Harshini. S, Imayatharasi. K.A.M, Innasi. T, Janaki. S, Janani. S, Babu Thandapani. A, Ramkumar. S

Department of pharmaceuticals, Ultra College of Pharmacy, Madurai, Tamilnadu, India

*Corresponding Author: Aruna. A

Email id: arunasanjayabinav@gmail.com



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Abstract: Herbal cosmetics have gained significant attention due to their safety, efficacy, and minimal side effects compared to synthetic formulations. The present study aims to formulate and evaluate a polyherbal anti-dandruff liquid shampoo using natural plant extracts. The formulation includes *Clitoria ternatea*, *Nyctanthes arbor-tristis*, *Murraya koenigii*, and *Sapindus trifoliatus*, which possess antifungal, cleansing, and hair-strengthening properties. The extracts were prepared using maceration and decoction methods. The shampoo was formulated using Hydroxypropyl methylcellulose (HPMC) as a thickening agent along with suitable preservatives. Evaluation parameters such as pH, viscosity, foaming ability, dirt dispersion, and antifungal activity were performed. The formulated shampoo showed satisfactory physicochemical properties and effective antifungal activity against *Candida albicans*. The results indicate that the developed polyherbal shampoo can be a safe and effective alternative to synthetic shampoos.

Keywords: Polyherbal shampoo, Anti-dandruff, *Malassezia*, Natural surfactant, Anti-fungal

1. INTRODUCTION

Herbal medicine has been an integral part of human healthcare since ancient times and continues to play a significant role in modern therapeutic and cosmetic applications. Herbal formulations are widely accepted due to their safety, biocompatibility, cost-effectiveness, and minimal side effects. The World Health Organization (WHO) has also recognized the importance of traditional medicine and encourages the integration of herbal products into modern healthcare systems. In recent years, the cosmetic industry has witnessed rapid growth, with hair care products constituting a major segment. Among these, shampoos are one of the most commonly used products for maintaining scalp hygiene and hair health. The primary function of a shampoo is to remove dirt, excess sebum, dandruff, and environmental pollutants from the scalp and hair.

Conventional shampoos available in the market are mainly formulated using synthetic surfactants, preservatives, and additives such as sodium lauryl sulfate (SLS), parabens, and silicones. Although these ingredients enhance cleansing and foaming properties, their prolonged use has been associated with various adverse effects, including scalp irritation, dryness, hair damage, allergic reactions, and even potential toxicity.

Dandruff is one of the most common scalp disorders affecting nearly 50% of the global population. It is characterized by flaking of the scalp, itching, dryness, and irritation. The primary cause of dandruff is associated with the overgrowth of fungi, particularly *Malassezia* species, along with factors such as excessive sebum production, poor hygiene, stress, and environmental conditions. Conventional anti-dandruff shampoos often

contain antifungal agents like ketoconazole, zinc pyrithione, or selenium sulfide, which may provide temporary relief but can cause side effects with long-term use.

Herbal anti-dandruff shampoos offer a promising alternative by incorporating plant extracts with natural antifungal, anti-inflammatory, and cleansing properties. Polyherbal formulations, which combine multiple plant ingredients, are especially beneficial due to their synergistic effects. These formulations not only target dandruff-causing microorganisms but also nourish the scalp, strengthen hair roots, and promote overall hair health.

2. PLANT PROFILE

2.1. Butterfly Pea

Botanical Name : *Clitoria ternatea* L.

Family : *Fabaceae* (Subfamily: *Faboideae*, Tribe: *Phaseoleae*)

Biological Source : The plant consists of the roots, seeds, leaves, and flowers of *Clitoria ternatea*

Uses: Butterfly pea acts as a natural anti-inflammatory and antioxidant booster that soothes scalp irritation and strengthens hair roots when paired with anti-dandruff treatments.



Fig 1. Flower of *Clitoria ternatea* L

2.2. Night- Flowering Jasmine

Botanical name : *Nyctanthes arbor-tristis*

Family : *Oleaceae*

Biological Source : *Nyctanthes arbor-tristis* Linn.

It consists of the flowers and leaves of *Nyctanthes arbor-tristis*.

Uses: Pavalamalli (Night Jasmine) seeds and leaves possess potent **antifungal and antibacterial properties** that specifically target dandruff-causing fungi and soothe scalp infections.

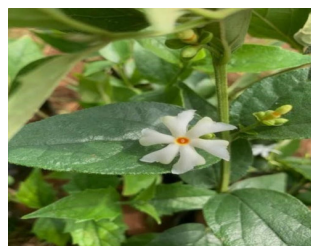


Fig 2. Leaves of *Nyctanthes arbor-tristis*

2.3. Soap Nut

Botanical Name : *Sapindus trifoliatus* Linn (South Indian), *Sapindus mukorossi* Gaertn (North Indian)

Family : *Sapindaceae*

Biological Source : Soapnut consists of the dried pericarp (fruit rind) of *Sapindus trifoliatus* Linn and *Sapindus mukorossi* Gaertn., belonging to the family *Sapindaceae*.

Uses: Soapnut is used in shampoos as a natural foaming and cleansing agent that removes dirt and oil, reduces dandruff, prevents hair fall, and adds shine to hair.



Fig 3. Friut of *Sapindus trifoliatus*Linn

2.4. Curry Leaves

Botanical Name : *Murraya konini. L*

Family : *Rutaceae*

Biological Source : Curry leaves consist of the fresh or dried leaves of *Murraya koenigii (L.)* Spreng, belonging to the family *Rutaceae*.

Uses: Curry leaves are used in shampoos to strengthen hair roots, reduce hair fall and dandruff, promote hair growth, and improve scalp health.



Fig 4. Leaves of *Murraya koenigii, L*

3. MATERIALS AND METHODOLOGY

3.1. List of Chemicals

- HPMC (Hydroxypropyl methylcellulose)
- Propyl paraben
- Methyl paraben
- Water

3.2 List of instruments used

- Digital weighing balance
- Autoclave
- Incubator
- Hot air oven
- Hot plate
- Water bath

3.3. PROCEDURE

3.3.1. Extraction of *Clitoria Ternatea.L*

Collection of the plants:

The flower of *Clitoria ternatea.L.*, was collected in the **Madurai, Tamilnadu**. Then the plant part was identified and authenticated by **Dr.Stephen, Ph.D(Retd), American college Madurai, Tamilnadu**.

Drying of the *Clitoria ternatea.L:*

Plant samples are dried in a shaded, in well-ventilated area at room temperature. This method preserves bioactive compounds and prevents UV-induced degradation. Samples are monitored to avoid moisture, mold, and insect contamination.

Method of extraction:

Maceration method is used for the extracting the constituents from the dried samples. 25 g dried flower is soaked in 300 mL distilled water. Kept at room temperature (25–30°C) for 72 hours with intermittent shaking. Then mixture is filtered, and the filtrate is concentrated (water bath under reduced pressure).

3.3.2. Extraction of Nyctanthes Arbor-Tristis Linn

Collection of the plants:

The plant part of *Nyctanthes arbor-tristis Linn*, was collected in the **Madurai, Tamilnadu**. Then the plant part was identified and authenticated by **Dr.Stephen,Ph.D(Retd)., American college Madurai, Tamilnadu**.

Drying of the *Nyctanthes arbor-tristis Linn:*

Plant samples are dried in a shaded, in well-ventilated place at room temperature. Helps preserve bioactive constituents and prevents UV degradation. Protect from moisture, mold, and insects.

Method of extraction:

Maceration method is used for the extracting the constituents from the dried samples. 25 g dried leaves soaked in 500 mL distilled water. Kept at 25–30°C for 72 hours with occasional shaking. Mixture is filtered, and filtrate is concentrated using a water bath under reduced pressure.

3.3.3. Extraction of Murraya Koenigii.L

Collection of the plants:

The leaves of *Murraya koenigii .L*, was collected in the **Madurai, Tamilnadu**. Then the plant part was identified and authenticated by **Dr.Stephen,Ph.D(Retd)., American college Madurai, Tamilnadu**.

Drying of the *Murraya koenigii.L:*

Leaves are dried in a shaded, in well-ventilated area at room temperature. Preserves bioactive compounds and prevents UV degradation. Avoid moisture, mold, and insects.

Grinding:

Dried leaves are ground into fine powder. Increases surface area and improves extraction efficiency.

Method of extraction:

Maceration method is used for the extracting the constituents from the dried samples. 25 g dried leaf powder soaked in 500 mL distilled water. Kept at 25–30°C for 72 hours with intermittent shaking. Filtered and concentrated using water bath under reduced pressure.

3.3.4. Extraction of Sapindus Trifoliatus.L

Collection of the plants:

The fruit of *Sapindus trifoliatus.L.*, was collected in the **Madurai, Tamilnadu**. Then the plant part was identified and authenticated by **Dr.Stephen,Ph.D(Retd)., American college Madurai, Tamilnadu**.

Drying of the *Sapindus trifoliatus.L:*

Fruit samples are dried in a shaded, well-ventilated area at room temperature. For Preserves active constituents and prevents degradation. To Protect from moisture, mold, and insects.

Grinding:

Dried fruits are ground into powder. Enhances surface area and improves extraction efficiency.

Method of extraction:

Decoction method is used for the extracting the constituents from the dried samples. 25 g powder dissolved in 100 mL distilled water. Boil for 10 minutes, then simmer for 30–60 minutes with stirring. Cool, filter (cloth/strainer), and store the extract in a clean container.

4. FORMULATION OF POLYHERBAL ANTI-DANDRUFF LIQUID SHAMPOO

4.1. Requirements

Table 1. Requirements for the polyherbal anti-dandruff liquid shampoo

S.No	Name Of Ingredients	Quantity To Be Taken
1.	Hydroxypropyl methylcellulose (HPMC)	5g
2.	Methyl paraben	0.4g
3.	Propyl paraben	0.2g
4.	Water	q.s
5.	Fragrance	q.s
6.	<i>Clitoria ternatea.L.</i> extract	25ml
7.	<i>Nyctanthes arbor-tristis.L.</i> extract	25ml
8.	<i>Murraya koenigii.L.</i> extract	15ml
9.	<i>Sapindus trifoliatius.L.</i> extract	15ml

4.2. Procedure for Preparation of Polyherbal Anti-Dandruff Liquid Shampoo

- Weight required quantities *Clitoria ternatea.L.*, *Nyctanthes arbor-tristis.L.*, *Murraya koenigii.L.*, *Sapindus trifoliatius.L.*, of extracts and mix uniformly to obtain polyherbal extract.
- Add HPMC slowly add with continuous stirring to form a uniform base.
- Add preservative (q.s).
- Finally add fragrance few drops and mix gently.
- Transfer the prepared formulation into a clean, wide-mouth container and store in a cool, dry place.

5. EVALUATION OF POLYHERBAL ANTI-DANDRUFF LIQUID SHAMPOO

1. Organoleptic Character
2. Ph Determination
3. Dirt Dispersion Test
4. Foaming Index
5. Percentage Solid Content
6. Stability Studies
7. Viscosity
8. Density
9. Washability Test
10. Skin Irritation Test

1. Organoleptic Character

Changes in the form, odour, and colour of the anti-dandruff gel shampoo, containing various concentrations were observed.

2. pH Determination

The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C. The pH was measured by using digital pH Meter.

3. Foaming index

Cylinder shake method was used for determining foaming ability.

5 ml of shampoo was taken into measuring cylinder and volume was make upto 25 mL and shaken properly for ten times. Then 5 test tubes were taken and stock solution was measured as given in following observation table. And each test tube was adjusted for volume upto 10mL by adding water. Then foam in each test was measured in cm and foaming index was calculated.

4. Dirt dispersion test

Two drops of shampoo were added in a large test tube contain 10 ml of distilled water. 1 drop of India ink was added and the test tube was stoppered and shakes it ten times. The amount of ink in the foam was estimated as None, Light, Moderate, or Heavy.

5. Percentage solid content

A clean dry evaporating dish was weighed and added 4 grams of shampoo to the evaporating dish. The dish and shampoo was weighed. The exact weight of the shampoo was calculated only and put the evaporating dish with shampoo was placed on the hot plate until the liquid portion was evaporated. The weight of the shampoo only (solids) after drying was calculated.

6. Stability studies

The stability of the formulation was studied for a period of 4 weeks by keeping at temperature of 25-30°C

7. Washability test

Shampoo were applied on the skin and then ease and extent of washing with water were checked manually.

8. Skin irritation test

Prepared herbal shampoo was applied on skin for 5 minutes after that was washed and tested for irritation or inflammation to the skin.

9. Viscosity

Viscosity of shampoo was determined by using Ostwald's viscometer. The viscosity of herbal shampoo was measured by counting drops of herbal shampoo from the mark to bottom.

$$\text{Viscosity} = \frac{\text{Density of shampoo} \times \text{Timing of runoff of shampoo} \times \text{viscosity of water}}{\text{Density of water} \times \text{Time of runoff of water}}$$

10. Density

First take a empty weight of pycnometer, then fill it till neck with shampoo and then weight it along with shampoo. Again fill the pycnometer with water and weigh it.

$$\text{Density} = \frac{\text{Weight of pycnometer with shampoo} - \text{Weight of empty pycnometer}}{\text{Weight of pycnometer with water} - \text{Weight of empty pycnometer}}$$

6. INVITRO ANTI-FUNGAL ACTIVITY OF POLYHERBAL ANTI-DANDRUFF LIQUID SHAMPOO

The microorganisms used for anti-fungal studies are *Candida albicans*- clotrimazole is used as standard drug.

6.1. Preparation of Nutrient Broth:

- 1.3 g of Nutrient Broth was weighed and dissolved in 100 ml of distilled water in a 250 ml of conical flask.
- It was placed in autoclave and sterilized at 121°C at 15 lbs for 15min.
- Then the solution was transferred to a test tube and microorganism (*Candida albicans*) are sub cultured.
- The test tubes are incubated at 37°C for 48 hours finally the subculture are used for further procedures.

6.2. Preparation of Sabouraud Dextrose Agar Media:

- 6.5g of sabouraud dextrose agar was weighed and dissolved in 100 ml of distilled water in a 250 ml of conical flask.
- It was placed in autoclave and sterilized at 121°C at 15 lbs for 15min.
- Then it was removed from autoclave and it was cooled in running water.
- Then the solution was placed in the petri dish which was already sterilized. Allowed to solidify.

6.3. Standard antibiotics used against microorganism:

Table 2.

Micro organism	Standard antibiotics
<i>Candida albicans</i>	Clotrimazole

6.4. Inoculation of plates

- Sterile cotton swab was dipped into the standardized fungal suspension.
- Excess inoculum was removed by lightly pressing the swab against the tube wall a level above that of the liquid.
- The agar medium prepared in the petri dish was inoculated by spreading with the containing the inoculum.
- The plate was turned by 90 and spreading process was repeated to produce even distribution of inoculum.
- The surface of medium should be allowed to dry for 3-5minutes.
- Then the centre were inserted by the sterilised disc.
- The disc was previously dipped by the polyherbal anti-dandruff liquid shampoo.
- Finally incubated at 37°C for 48 hours.
- The standard drug clotrimazole (2 mg/ml) was used against *Candida albicans*.

6.5. Measurement of zone of inhibition:

- After incubation period is over, the diameter of zone of inhibition was measured in milli meter side of the ruler.
- The measurement was taken with ruler from the centre of Antibiotic disc to edge of zone of inhibition.
- Then the measurement of radius in zone of inhibition and it is multiplied by 2 to get the value in diameter.
- Finally we get the diameter of zone of inhibition.

7. RESULT & DISCUSSION

7.1. Preparation of Polyherbal Anti-Dandruff Liquid Shampoo

The *Clitoria ternatea. L.*, *Nyctanthes arbor-tristis. L.*, *Murraya koenigii L.*, *Sapindus trifoliatus. L.* are individually extracted and added to prepare polyherbal anti-dandruff liquid shampoo. The shampoo was made up to 100 ml and stored in an airtight container.

7.2. Evaluation of Polyherbal Anti-Dandruff Liquid Shampoo

1) Organoleptic test

In this test, colour, odour, state, and texture of the formulation was identified.

Table 3.

S.No	Specification	Observation
1.	Colour	Dark Purple
2.	Odour	Floral
3.	Texture	Smooth
4.	State	Liquid



Fig No: 5

2) pH determination

The pH of the formulated shampoo was 5.5, which is present within the ideal pH limit for shampoo which is between 4.5 and 7. The formulated shampoo is acid balanced, which is near to the scalp pH. The pH of shampoo is important for enhancing the texture of hair, stabilizing the nature of the scalp and minimizing irritation to the eyes.



Fig No: 6

3) Dirt dispersion test

10 ml of distilled water is added to the test tube. Later, the test tube is filled with two drops of the shampoo formulation. After that, the test tube is filled with one drop of India ink. After that, the test tube is sealed with a cork and shaken ten times. The findings were written as "None," "Light," "Moderate," or "Heavy" depending on how much ink was used.

4) Foaming index

The foaming index of a shampoo measure its capacity to produce foam, indicating cleaning efficiency and user satisfaction, often determine via the shake method.

$$\text{Foaming index} = 1000 / A = 500$$

Where A is the volume in ml of the decoction used for preparing the dilution in the tube Where foaming to a height of 1cm is observed. The foaming index is 500.

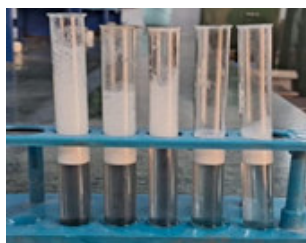


Fig No: 8

5) Percentage of solid content:

The result of percentage of solid content 3.44 %.



Fig No: 9



Fig No: 10

6) Stability studies

Stability of formulation during the storage period indicated that they are physically and chemically stable. The formulated herbal shampoo is stable at a standard room temperature of 25-30 °C. The results indicate that it possesses good stability within two weeks of the stability study.

7) Viscosity

The viscosity of the shampoo plays an important role in determining the ease of flow on removal from packing and spreading on application to hair, its shelf-life stability, and product consistency in the package. The viscosity of the formulated shampoo was found to be 0.67 poise or pascal. sec, which was good enough for its applicability.

8) Density

The density of the shampoo was found to be 1.1gm/ml which was good enough for its compactness.

9) Washability

Washability test usually results in a product that leaves no heavy residue or oil, rinses off quickly, and produces a manageable foam.



Fig No: 11

10) Skin irritation test

The formulated shampoo shows no redness, edema, inflammation and irritation during irritation study.



Fig No: 12

7.3. Invitro Anti-Fungal Activity of Polyherbal Antidandruff Liquid Shampoo

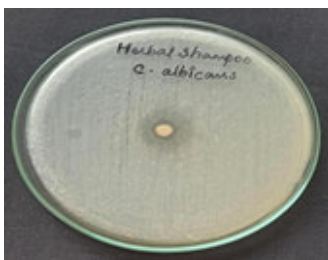


Fig No: 13. *Candida albicans* -polyherbal anti-dandruff liquid shampoo (sample)

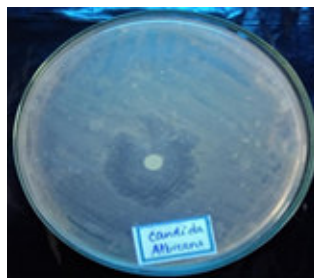


Fig No: 14. *Candida albicans* – clotrimazole solution (standard)

Measurement of zone of inhibition:**Table No: 4**

Sample	Zone of inhibition (mm)
	<i>Candida albicans</i>
Polyherbal anti-dandruff liquid shampoo	18
standard	40

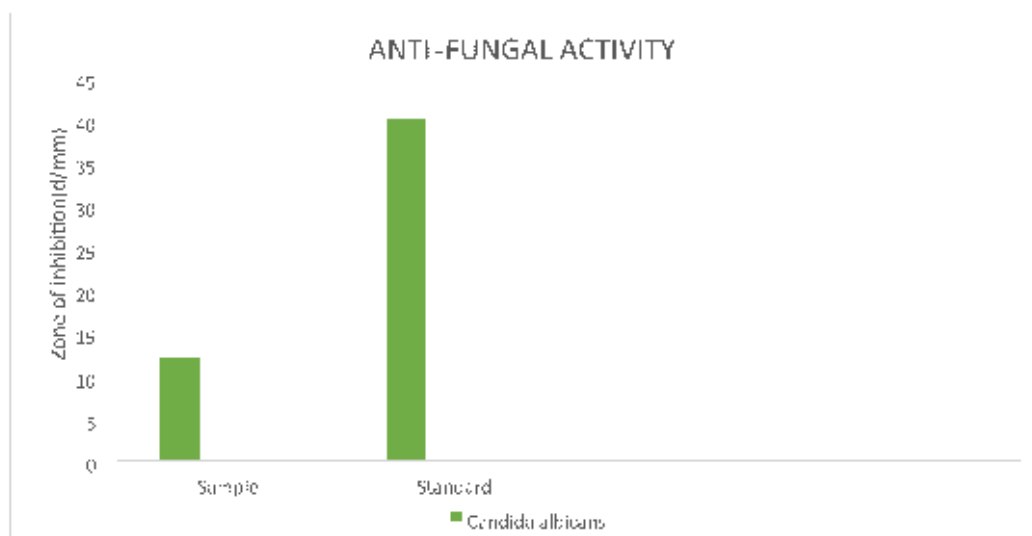
**Graph 1. Anti-Fungal Activity****7.4. In Vitro Antifungal Activity**

Fig No: 13 *Candida albicans*-polyherbal anti-dandruff liquid shampoo (sample) zone of inhibition is **18mm**.

Fig No: 14 *Candida albicans*-clotrimazole solution (standard) zone of inhibition is **40 mm**.

The polyherbal anti-dandruff liquid shampoo of anti-fungal activity produces moderate effect than standard.

8. CONCLUSION

In the project work, it was decided to extract and formulate polyherbal anti-dandruff liquid shampoo, the selected plant was *Clitoria ternatea.L.*, *Nyctanthes arbor-tristis.L.*, *Murraya koenigii.L.*, *Sapindus trifoliatus.L.*, it is readily available in local area and market and the selected excipients such as Hydroxy Propylmethyl Cellulose (HPMC), Methyl paraben, Propyl paraben, Water.

The formulation of *Clitoria ternatea.L.*, *Nyctanthes arbor-tristis.L.*, *Murraya koenigii.L.*,

Sapindus trifoliatus.L., polyherbal anti-dandruff liquid shampoo was done by extraction method and further evaluated parameter such as organoleptic character, pH determination, dirt dispersion test, foaming index, percentage solid content, stability studies, viscosity, density, washability test, skin irritation test.

The formulated polyherbal anti-dandruff liquid shampoo has good texture and consistency, and passes all the evaluation studies performed which indicated polyherbal anti-dandruff liquid shampoo was capable to reduce the dandruff and promotes the hair strength.

REFERENCES

- [1] Dhandge PD, Deshmukh SP. A review on role of herbal medicine in daily life. GSC Biol Pharm Sci. 2023; 25(3):179–188.
- [2] Mehta D, Thakur A, Upadhyay D, Andhare P, Bhattacharya I. Comparative study between naturally formulated herbal shampoo and commercially available shampoo. Bull Environ Pharmacol Life Sci. 2022; Spl Issue (3):301–305.
- [3] Bhagwat SS, Paulbudhe NJ. Formulation and evaluation of herbal shampoo. IJCRT. 2020; 8(9):2860–2869.

- [4] Ramanamma L, Pragnya K, Likhitha N. Formulation and evaluation of herbal shampoo. GSC Biol Pharm Sci. 2025; 30(2):281–288.
- [5] Pharmacy180. Types of shampoo in cosmetic formulation [Internet]. Available from: <https://www.pharmacy180.com/article/types-of-shampoo-819>
- [6] Jadhav A. Formulation and evaluation of *Murraya koenigii* and *Trigonella foenum* for hair promoting activity. Int J Pharmacogn Clin Res. 2023; 5(2):4–11.
- [7] Erdoğan B. Anatomy and physiology of hair. InTechOpen. Available from: <http://dx.doi.org/10.5772/67269>
- [8] Jeet I, Kumar S, Kumar R, Nagpal S, Pandey D. A review on antidandruff shampoo. JETIR. 2024; 11(5):m180–m183.
- [9] More A, Kharade R, Devkate V, Gaikwad S, More A. Formulation and evaluation of herbal shampoo using natural ingredients. IRJMETS. 2024; 6(5):5286–5296.
- [10] Kumar D, Rajora G, Parkash O, Antil M, Kumar V. Herbal cosmetics: An overview. All Sci J. 2016; 1(4):36–41.
- [11] Shinde GS, Kale MA, Jagtap PV, Waghmode YD. Polyherbal shampoo: formulation and evaluation. IJCRT. 2023; 11(8): g147–g151.
- [12] Bhavani MS, Jan SM, Rani KS, Srirekha M. Formulation, evaluation and comparison of herbal shampoo with commercial shampoos. Int J Pharm Sci Rev Res. 2023; 78(1):41–45.
- [13] Assegaf TS, Jusuf NK, Pane YS, Darmani EH, Amin MM, Lubis RDS, et al. Anti-dandruff effects of *Clitoria ternatea*-based shampoo. 2024; 4(2): e876:1–12.
- [14] Jeyaraj EJ, Lim YY, Choo WS. Extraction methods of butterfly pea flower and biological activities. J Food Sci Technol. 2021; 58(6):2054–2067.
- [15] Kumar SR, Sherief SH, Tawale H, Chavan AB, Mohammed JS, Latha CM, et al. Comprehensive evaluation of *Clitoria ternatea*. Afr J Bio Sci. 2024; 6(14):5979–5998.
- [16] Ashokkumar K, Sundaram M, Dharshini T, Janani T, Shrravanisri V, Subhasidha R. *Nyctanthes arbor-tristis*: extraction techniques and biological impacts. Future J Pharm Sci. 2024; 10:117.
- [17] Rawat H, Verma Y, Ayesha, Saini N, Negi N, Pant HC, et al. *Nyctanthes arbor-tristis*: traditional herbal plant. 2021; 6(3):427–440.
- [18] Gupta G, Kaur AK, Kumar A. Review on *Nyctanthes arbor-tristis* Linn. World J Pharm Sci. 2021; 9(3):160–169.
- [19] Mankar SD, Bhosale MS, Shelke M, Sonawane P. Review on *Murraya koenigii* for hair growth. Res J Pharmacogn Phytochem. 2021; 13(1):39–43.
- [20] Bochare A, Aher S, Jadhav D. Review article on curry leaf (*Murraya koenigii*). IJCRT. 2023; 11(1):c912–c922.
- [21] Kale K, Somani S. Herbal cream shampoo for curry leaves. JETNR. 2023; 1(12):a41–a56.
- [22] Thakur D, Sachar D, Sharma P. Soapnut shampoo: a natural and sustainable hair care shampoo. IJPRA. 2025; 10(2):1391–1402.
- [23] Suhagia BN, Rathod IS, Sindhu S. *Sapindus mukorossi*: an overview. IJPSR. 2011; 2(8):1905–1913.
- [24] Bhalekar MR, Padher S, Ashwini, Madgulkar R. Evaluation of aqueous extract of soapnut as surfactant. JPP. 2017; 6(4):1318–1320.
- [25] Parthiban R, Priyadharshini R, Mohanraj S, Krishna MA, Poyyathappan V, Sivakumar M, et al. Ecological and health benefits of *Clitoria ternatea*. 13(14):51–559.
- [26] Solanki M, Rajhans S, Pandya HA, Mankad AU. *Nyctanthes arbor-tristis*: a short review. WJPPS. 2021; 10(3):1047–1054.
- [27] Parveen U, Khan UA, Tangri S, Noman M, Maaz M. *Sapindus trifoliatus*: review. 2020; 5(4):252–256.
- [28] Planet Ayurveda. *Murraya koenigii* L. Sprengel [Internet]. Available from: <https://www.planetayurveda.com>
- [29] Rowe RC, Sheskey PJ, Quinn ME. Handbook of Pharmaceutical Excipients. 6th ed. London: Pharmaceutical Press; 2009. P: 326-329, 651-653, 441-445, 596-598, 766-770.
- [30] Chakraborty S, Pal A, Bala NN. Extracts of *Clitoria ternatea* using different methods. J Pharm Res Int. 2023; 35(21):47–53.
- [31] Daund AK, Jadhav RS, Vikhe DN. Review on *Nyctanthes arbor-tristis* leaves. WJPMR. 2022; 8(4):128–132.
- [32] Patel M, Thakkar M. Extraction and application of cardiac glycoside from *Murraya koenigii*. IJCRT. 2022; 10(11): d518–d528.

- [33] Wang Z, McLenahan C, Abraham L. Soapnut extract in green chemistry education. *RSC Sustain.* 2024; 2: 3788–3797.
- [34] Pal RS, Saraswat N, Wal P, Wal A, Pal Y. Poly-herbal anti-dandruff formulation. *Open Dermatol J.* 2020; 14: 22–27.
- [35] Kothari S, Patidar K. Polyherbal shampoo for antifungal activity. *Asian J Pharm.* 2018; 12(3): S1021–S1027.
- [36] Mankar T, Wairagadwar P, Pimpale A, Zode P, Mahurka H. Physicochemical evaluation of polyherbal anti-dandruff shampoo. *Int J Pharm Sci.* 2025; 3(12):3883–3896.
- [37] Katkale A, Jadhav R, Sonawane S. Polyherbal antidandruff shampoo. *Res J Topical Cosmet Sci.* 2024; 15(2):63–69.
- [38] Lahamage PB, Potkule MD, Udapurkar P. Antidandruff herbal shampoo. *IJCRT.* 2023; 11(5): k653–k659.
- [39] Dahake PS, Pawar SR, Surwase KP. Herbal shampoo formulation and evaluation. *IJARST.* 2025;5(1):452–467.
- [40] Girase AA, Patil JK, Harsola RK, Jadhav DM, Pawar SP. Liquid herbal shampoo formulation. *WJPR.* 2019; 8(7):1272–1279.
- [41] Shinde SS. Formulation and evaluation of herbal shampoo [BPharm thesis]. Lonere: Dr. Babasaheb Ambedkar Technological University; 2024: a216-a236.