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PHYTOCONSTITUTIVE INTEGRATION OF *MORINGA OLEIFERA* IN A POLYHERBAL SHAMPOO MATRIX: FORMULATION, OPTIMIZATION, AND MULTIFACTORIAL EVALUATION

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Abstract

The study focuses on the formulation and evaluation of a herbal shampoo incorporating Moringa oleifera as main ingredient. The primary objective was to create a shampoo that utilizes natural ingredients, including Aloe vera, Soapnut, Shikakai, Olive leaves, Amla, Neem, Henna, and Marigold, alongside Moringa, that serve as a hair tonic, conditioner, and moisturizer. The research involved a comprehensive analysis of the physiochemical properties of the formulated shampoos, including viscosity, surface tension, cleaning action, stability, foaming ability, and skin irritation potential. Various extraction methods, such as Decoction, Soxhlet, and Maceration were employed to obtain the herbal extracts. Phytochemical analysis shows that it has Alkaloids, Saponins, tannins, Steroids, Phenolic acids, Flavonoid's glycosides & Terpenes. The results indicated that the formulated herbal shampoos exhibited excellent qualitative and quantitative properties, demonstrating their effectiveness as safe and cost-effective alternatives to synthetic shampoos. The F5 formulation, which contained a high number of herbal extracts, demonstrated a sharp decrease in water surface tension, efficient cleaning ability, high emulsion percentage, high wetting ability, good foaming action, and foam stability compared to other formulations. The findings of this research suggest that the inclusion of Moringa oleifera in shampoo formulations can enhance hair health and provide a natural solution to common hair issues, thereby contributing to the growing demand for herbal personal care products.

Keywords: Herbal Shampoo, Cost Effective, Cleaning Action, Moringa Oleifera, Polyherbal Extracts.

INTRODUCTION

The quest for effective hair care solutions has led to the increasing popularity of herbal shampoos, which are perceived as safer alternatives to synthetic products. Traditional

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hair care practices have utilized various herbs from centuries, leveraging their natural properties to enhance hair health and appearance. Among these, *Moringa oleifera*, commonly known as the drumstick tree, has garnered significant attention due to its rich nutritional profile and therapeutic benefits. This plant is native to the sub-Himalayan regions of India and is recognized for its high content of vitamins, minerals, and antioxidants, which contribute to its efficacy in promoting hair health [1]. The adverse effects of synthetic shampoos, which often contain harsh chemicals and surfactants, have prompted consumers to seek natural alternatives. Prolonged use of synthetic shampoos can lead to scalp irritation, hair loss, and dryness, highlighting the need for formulations that are both effective and gentle on the hair and scalp [2].

Herbal shampoos, particularly those formulated with polyherbal combinations, offer a promising solution by harnessing the synergistic effects of multiple plant extracts. Ingredients such as Amla (*Phyllanthus emblica*), Neem (*Azadirachta indica*), and Shikakai (*Acacia concinna*) are well-documented for their beneficial properties, including antifungal, antibacterial, and conditioning effects [3]. The formulation of herbal shampoos involves the careful selection of plant extracts based on their individual properties and the desired outcomes for hair care. *Moringa oleifera,* with its antioxidant, anti-inflammatory, and antimicrobial properties, plays a crucial role in enhancing the overall effectiveness of the shampoo [4]. The incorporation of other herbs, such as Aloe vera, marigold and Reetha, further enriches the formulation, providing additional benefits such as moisture retention and cleansing action [5]. This research aims to develop a polyherbal shampoo formulation that utilizes *Moringa oleifera* and other beneficial herbs, assessing its physiochemical characteristics and comparing its performance with commercially available herbal shampoos.

This study employed various extraction methods, including Decoction, Soxhlet, and maceration to obtain the active constituents from the selected plants. The resulting formulations were evaluated for their cleaning ability, foaming capacity, stability, and overall consumer acceptability. By investigating the potential of a polyherbal shampoo containing unique plant extract combination, this study seeks to contribute to the growing body of knowledge surrounding natural hair care products and their efficacy. The findings are expected to provide insights into the formulation of effective, safe, and environmentally friendly hair care solutions that align with consumer preferences for natural ingredients. Ultimately, this research aims to establish a competitive herbal shampoo that not only meets the functional requirements of hair care but also promotes the use of sustainable and health-conscious products in the cosmetics industry.

MATERIALS AND METHODS

Chemicals

Sodium dodecyl Sulphate, Methyl Paraben, Citric Acid, Guar Gum, Ethanol, Methylene Blue, Glucose.

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Collection and Drying of Herbs

Polyherbal shampoo was prepared by using different parts of plants extracts including Amla (*Phyllanthus emblica*), Reetha (*Sapindus mukorossi*), Henna (*Lawsonia inermis*) and Lemon peel (*Citrus lemon*) in dried form. They were obtained from Nokher Pakistan on Oct 10, 2024. While Shikakai (*Acacia concinna*), Marigold (*Tagetes erecta*), Sohanjna (*Moringa oleifera*), were collected from main market Qilla Didar Singh, Pakistan on Oct.12,2024. Olive leaves (*Olea europaea*) and Linseed (*Linum usitatissimum*) were collected from Hafizabad, Pakistan on Oct 16, 2024. Aloevera (*Aloe barbadensis Miller*) and Neem (*Azadirachta indica*) were collected from home garden on Oct 14, 2024. The herbs were dried by cleaning them with water to remove contaminants. The sample was then placed under shade for 7-10 days and covered with a piece of cloth in order to avoid dust, soot, smut etc. [6].

Preparation of Herbal Extracts

To prepare the herbal extracts, three methods were employed: each of which has its own advantages and applications in the extraction of bioactive compounds from plant materials.

Extraction by Decoction Method

By using grinder (ND National Grinder JB-222), the dried herbs were thoroughly grinded to made a fine powder. A steel sieve of 100 Mesh US standard was used to sieve the powder as shown in figure 1. Then a glass container with distilled water was taken and placed sieved powdered sample in it. The ratio of sample to water was 1:16. The content of sample in glass container were heated until one-third part of it was left as shown in Figure 1. Then it was allowed to cool down at room temperature and filtered. The desired extracts were present in the filtrate and simmered it until the quarter of initial volume was left behind and preserved the extract in refrigerator until analysis. Same process was repeated with herbs i.e., Marigold, Neem, Lemon, Amla, Henna, Aloevera, Linseed, Soapnut, Olive leaves and Moringa [7].

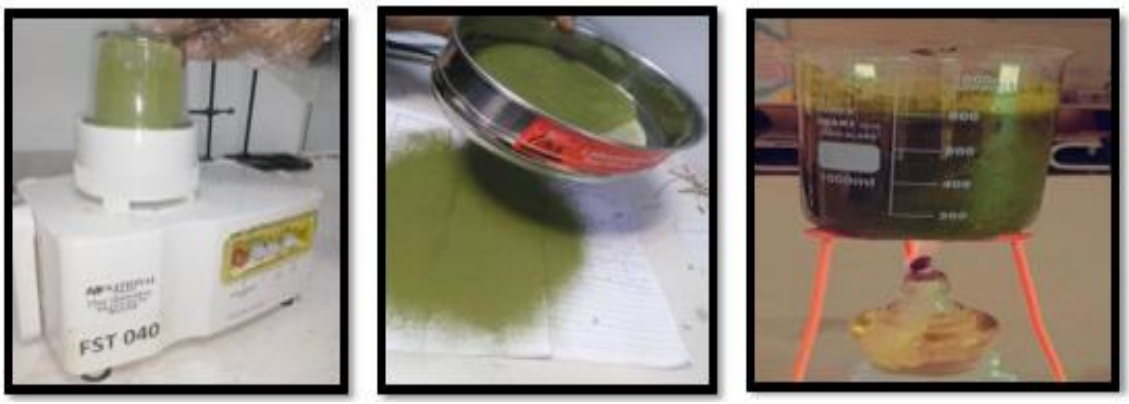

Figure 1: Grinding, Sieving and Heating

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Extraction by Soxhlet Method

In order to get bioactive components from neem Soxhlet extraction was used. In the porous thimble, powdered sample was placed. Ethanol and distilled water mixture was used as a solvent. The solvent to sample ratio was kept at 1:20. The temperature of solvent was maintained at 60C for 4 hours. The extraction was continued until all the soluble components were gathered in the round bottom flask as sown in Figure 2. After the extraction, by using the rotary evaporator, the solvent was evaporated and the extract was preserved [8].

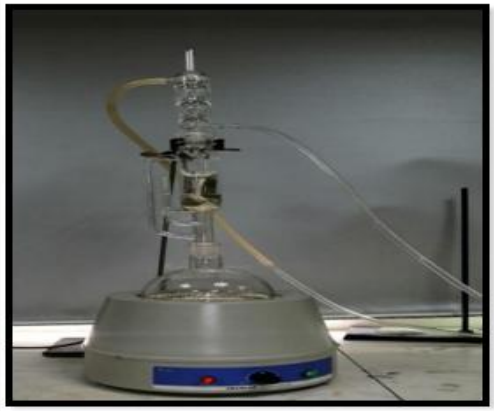

Figure 2: Soxhlet extraction of Neem

Extraction by Maceration Method

In this method, ethanol 20% was used as solvent. The herbs (shikakai and lemon) were grinded into a fine powder. In a glass beaker, herb powder was added with ethanol solution as shown in Figure 3. The sample ratio to ethanol was 1:20. With aluminum foil, the beaker was fully covered and sealed with woolen thread. It was shaken regularly and after 7 days the contents of this beaker were filtered. The filtrate was concentrated using rotary evaporator and then preserved for further use [9].

Figure 3: Extraction by Maceration

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Formulation of Herbal Shampoo

To create the herbal shampoo, various plant extracts were combined in specific proportions within 100 mL glass beakers, resulting in five unique polyherbal shampoo formulations labeled as F1, F2, F3, F4, and F5. The precise quantities of each extract utilized in these formulations are detailed in Table 1. Each formulation included methyl paraben as a preservative to enhance shelf life, along with a few drops of either a 10% citric acid solution or a 10% sodium dodecyl sulfate solution to maintain pH. To achieve the desired viscosity for each formulation, either guar gum or a gelatin solution was incorporated as needed. Additionally, peppermint was included to enhance the fragrance of the shampoos. The resulting formulations underwent testing to evaluate various physiochemical properties, ensuring their effectiveness and quality.

Table 1: Ingredients ratio for preparation of polyherbal shampoo

Ingredients	F1 (ml)	F2 (ml)	F3 (ml)	F4 (ml)	F5 (ml)
Marigold	1.5	2.5	2	1.5	1.5
Olive Leaves	2.5	3	3.5	2	1.5
Amla	2.5	3	3.5	1.5	2
Shikakai	2	2	1.5	2.5	2
Reetha	3	2.5	2	3.5	3
Lemon	0.5	0.5	0.5	0.5	0.5
Aloe Vera	4	3.5	3.5	4	3
Neem	1.5	1	1	1.5	1.5
Henna	1.5	2	2	1.5	1.5
Moringa Oleifera	5	4	4.5	6	8
Linseed	1	1	1	0.5	0.5
Sodium dodecyl Sulphate	q.s				
Methyl Paraben	q.s				
Citric Acid	q.s				
Guar Gum	q.s				
Peppermint oil	Few drops				

Physiochemical Analysis for Qualitative and Quantitative Study

Organoleptic evaluation of shampoo formulations was done for parameters like color, odor, taste and texture. Color and texture were evaluated by vision and touch sensation respectively.

For taste and odor, a volunteer was selected and results were reported [10].

For the determination of pH, 1% shampoo solution was made and tested by using pH meter (HI-8424, Portable pH Meter) as shown in Figure 4.

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Figure 4: Determination of pH of Samples

The shampoo stability was evaluated and observed on the basis of changes in color, odor and texture by keeping the shampoo in an air tight container at 37ºC for 2 weeks [11]. For determining foaming ability and stability "Cylinder shake method" was used. In a measuring cylinder 50 ml distilled water was taken and 5 ml herbal shampoo was added. Then it was covered with aluminum foil and shook for 10 times. By measuring the foam volume, the stability was observed as shown in Figure 5. The volume of foam showed minor decline in the duration of 5 minutes. Five readings were taken with the interval of one minute each [12]. For percentage solid content approximately 4 gm of the prepared herbal shampoo formulation was poured in a dry and clean evaporating china dish. The weight of both shampoo and dish was calculated by using digital weighing balance. The liquid content of the formulation was evaporated to determine its solid content by placing it on hot plate as shown in Figure 6.

Then solid content was determined by using the formula [13].

Percentage of the solids = Dried weight of shampoo **/** Initial weight of shampoo × 100

Figure 5: Percentage of Solid Contents

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The dirt dispersion test was performed in a “falcon tube” by adding few mL distilled water along with few drops of shampoo and swirled for 10 seconds. Then the ink (blue) was added about 1 drop and left for 10 minutes. Ink started settling down as shown in Figure 6. The amount of ink in the foam was estimated as none, heavy, moderate or light. [14].

Figure 6: Dirt Dispersion Test

For skin irritation test the solution of prepared shampoo was applied on skin (on the back of elbow) and kept for 5 minutes. Then it was observed for redness, irritation or any other changes [15]. A specific gravity bottle was taken and weighed. It was filled with water and weighed again. The prepared herbal shampoo was added in this weighed specific gravity bottle and its weight was noted [16]. The viscosity of the formulation measured by using the formula as shown in Figure 8.

$\eta_1 = \rho_2 t_2 / \rho_1 t_1 \times \eta_2$

η_1 = Water viscosity

ρ_2 = Formulation density

t_2 = Time of flow (formulation)

ρ_1 = Water density

t_1 = Time of flow (water)

η_2 = Viscosity of the formulation

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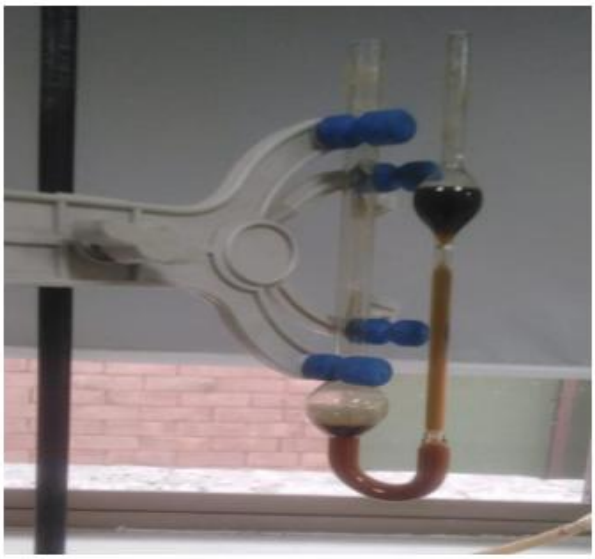

Figure 7: Measurement of Viscosity

RESULTS AND DISCUSSION

Herbs have been used for the herbal shampoo formulations since ages and are reported to show very good effects on hair growth, affective for dandruff removal, show good cleansing and conditioning action. The formulations are tested for all necessary physiochemical parameters and most of the analysis gave good results, comparable with commercially available herbal shampoo.

Prepared shampoos are light brown, smooth and have good odor (Table 2). Similar results from polyherbal shampoo have been reported by Gaurav Lodha *et al.* [17].

Cleaning action is an important parameter for testing shampoo quality. It was tested on wool yarn that was mixed with grease with a little modification in method [18]. The cleaning action of formulated shampoo was between 21 DP to 29 DP and out of five prepared formulations, F1 and F2 showed excellent results and the percentage cleaning action obtained from Reference herbal Bio amla shampoo was 26 DP so current formulation is in good agreement with marketed herbal shampoo. All these results are shown in Table 3 and its graphical representation is given in Figure 8.

Table 2: Organoleptic Evaluation of Shampoo Formulations

Sr. No.	Organoleptic Evaluation	Formulation					
		F1	F2	F3	F4	F5	Bio Amla
1	**Color**	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Green
2	**Odor**	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
3	**Taste**	Bitter	Bitter	Bitter	Bitter	Bitter	Bitter
4	**Texture**	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth

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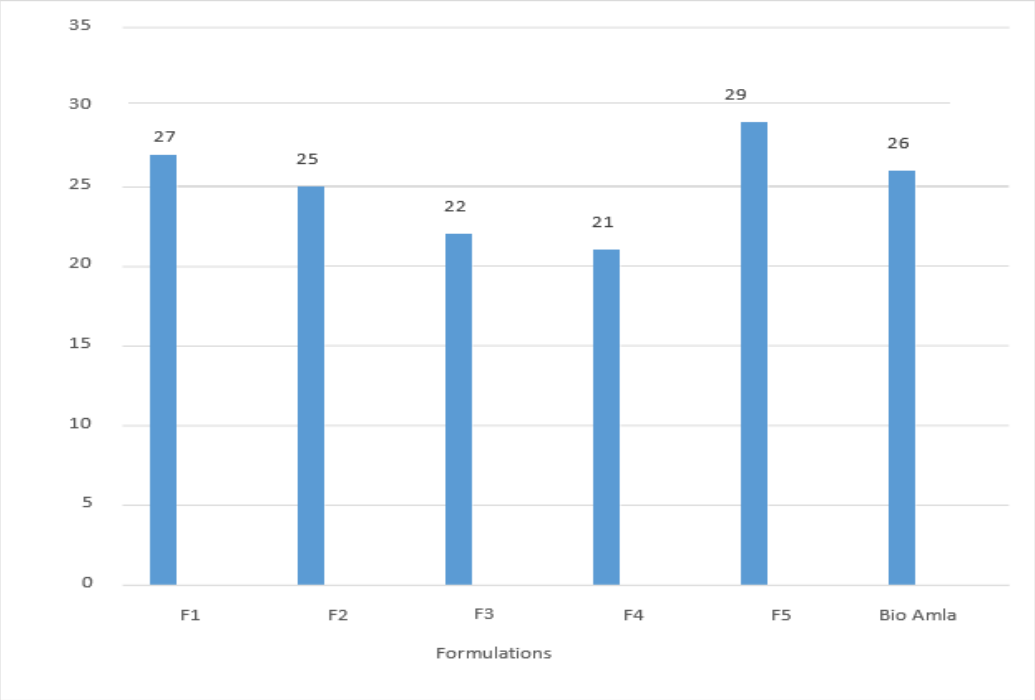

Figure 8: Graphical Representation of Cleaning Action

Table 3: Evaluation of Formulations for Surface Tension, % Slid Content, Wetting Time and Cleaning Action

Sr. No.	Formulation	Surface Tension	Solid Content (%)	Wetting Time (Seconds)	Cleaning Action
1	**F1**	36.75	20	122.4	27
2	**F2**	31.47	28	126.8	25
3	**F3**	30.83	20	127.3	22
4	**F4**	32.13	25	119.6	21
5	**F5**	35.98	21.5	130.7	29
6	**Bio Amla**	36.11	9.70	106.2	26

Percentage solid content is also another important parameter for qualitative testing of shampoo. If the shampoo has too many solid contents, it will be hard to apply or too difficult to wash out. Good quality shampoos usually contain 20-30% solid contents.

The result of percentage of solid contents of the present formulations was found between 20-28% and F2 showed highest solid content 28% and F3 showed the lowest solid content 20% while the percentage solid content of Reference shampoo was 9.70 as shown in Table 3 and Figure 9.

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Figure 9: Cleaning Action Test

The pH of shampoo is a key factor. It plays an important role in improving and enhancing the hair quality, minimizing eyes irritation and stabilizing scalp ecological balance.

The pH of formulated shampoos was between 5 to 5.9, lies within the ideal pH range i.e., 5 - 7.8. F4 showed highest pH value 5.8 and F2 showed the lowest pH 5.2 and the pH of Reference shampoo was 6.5 as shown in Table 3. Identical herbal shampoo pH was also reported by Sarath *et al*. [16].

Table 4: Evaluation of Formulation for pH, Viscosity and Emulsion Test

Formulation	pH	Viscosity (mP)	Emulsion Test
F1	5.6 ± 0.13	43	50.51
F2	5.23 ± 0.05	47	56
F3	5.6 ± 0.16	45.04	54
F4	5.8 ± 0.12	49.03	49.50
F5	5.81 ± 0.07	42.75	59
Bio Amla (Ref)	6.5 ± 0.12	47.33	58.52

The viscosity of a shampoo helps in determining its shelf life. It indicates the extent of fluidity, which makes formulation easy to apply and easy to spread on hair.

The viscosity of formulated shampoos was found between 42 to 50mP and out of five formulation F4 showed the best viscosity 49.03mP while F5 showed the lowest 42.75mP whereas the viscosity of Reference herbal shampoo was 47.33mP as shown in Table 4 and Figure 10. A similar viscosity i.e 50mP has been reported by Tanya Malpani *et al* [16].

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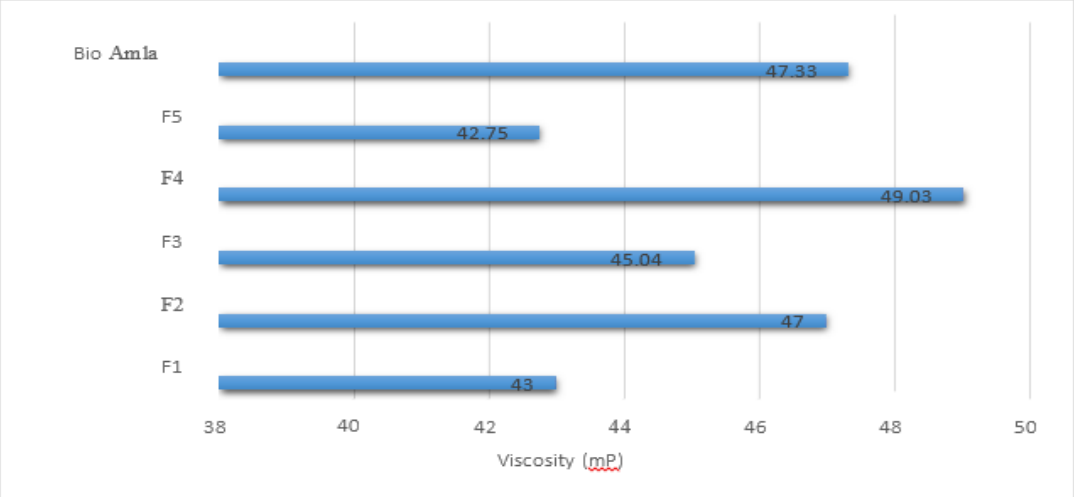

Figure 10: Graphical Data of Viscosity

Emulsion test performed in order to improve dispersion ability of a shampoo. The percentage emulsion of formulated herbal shampoo was found between 49.5 - 60 and out of five formulation F5 showed excellent emulsion 59 and F1 showed the lowest emulsion 50.51 as shown in Table 4 and Figure 11. The percentage emulsion of Reference shampoo was 58.52. To evaluate wetting ability of a shampoo “canvas disc method” was used with minor modifications [19]. The formulated herbal shampoo wetting time was found between 100-130 seconds while the ideal range reported by literature is between 140-190 seconds whereas the wetting time of bio amla shampoo was observed 106.2 seconds. Results are presented in table 4 & figure 12 respectively.

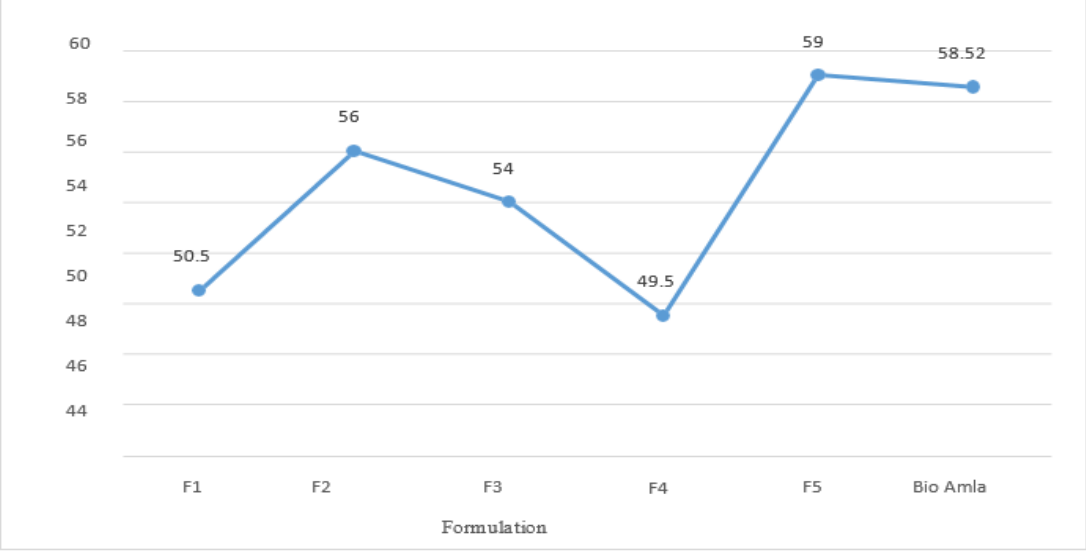

Figure 11: Graphical Data of Emulsion Test

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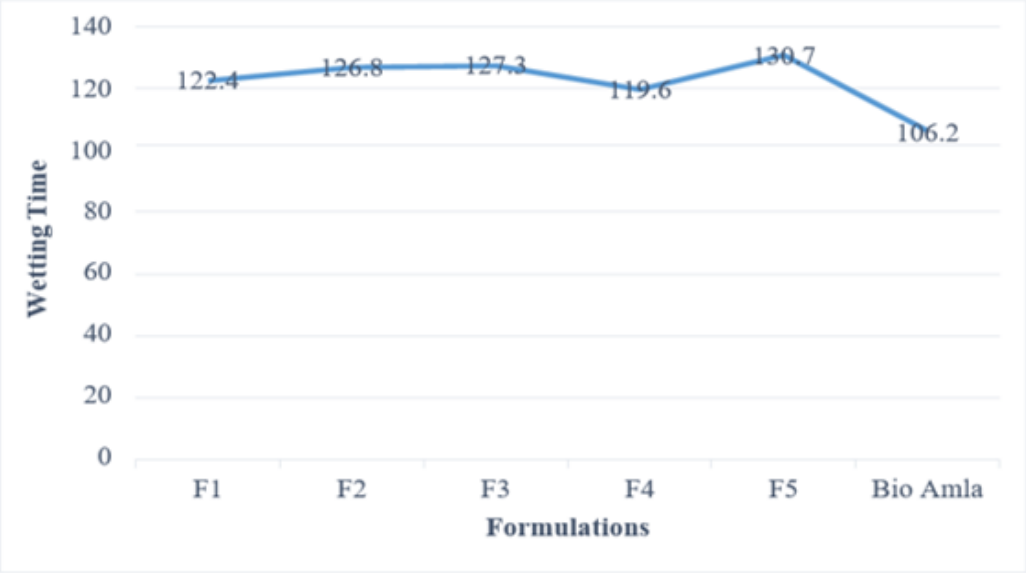

Figure 12: Graphical Representation of Wetting Time

Surface tension and cleaning ability are inversely proportional to each other [20]. For stronger cleaning ability the surface tension should be as low as possible. In the five prepared formulations, surface tension value lies between 30 to 36 dynes/ cm whereas that of reference, it appeared 36.1 dynes/cm respectively. Detailed results have been presented in Table 4 and Figure 13.

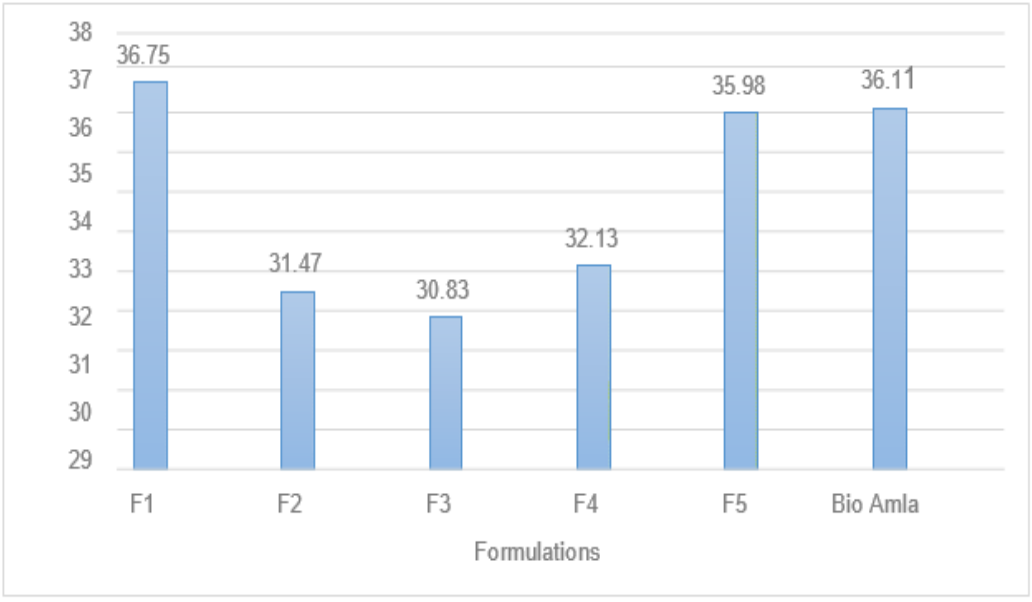

Figure 13: Graphical Representation of Surface Tension

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As foam production and retention is very important with respect to consumer acceptance. All the current formulations showed good foaming ability and retention comparable with the previous data. F1 showed the best foaming ability after 4 minutes (116 mL), F5 the least (100 mL) and Reference shampoo had 110 mL after 4 minutes respectively (shown in table 5 & figure 14)

Table 5: Formulations Values of Foaming Ability

Sr. No.	Formulation	Foaming Ability (ml)				
		Initial Reading	After 1min	After 2min	After 3min	After 4min
1	F1	120	119	118	117	116
2	F2	112	111	110	109	108
3	F3	108	107	106	105	104
4	F4	115	114	113	112	111
5	F5	104	103	102	101	100
6	Bio Amla	114	113	112	111	110

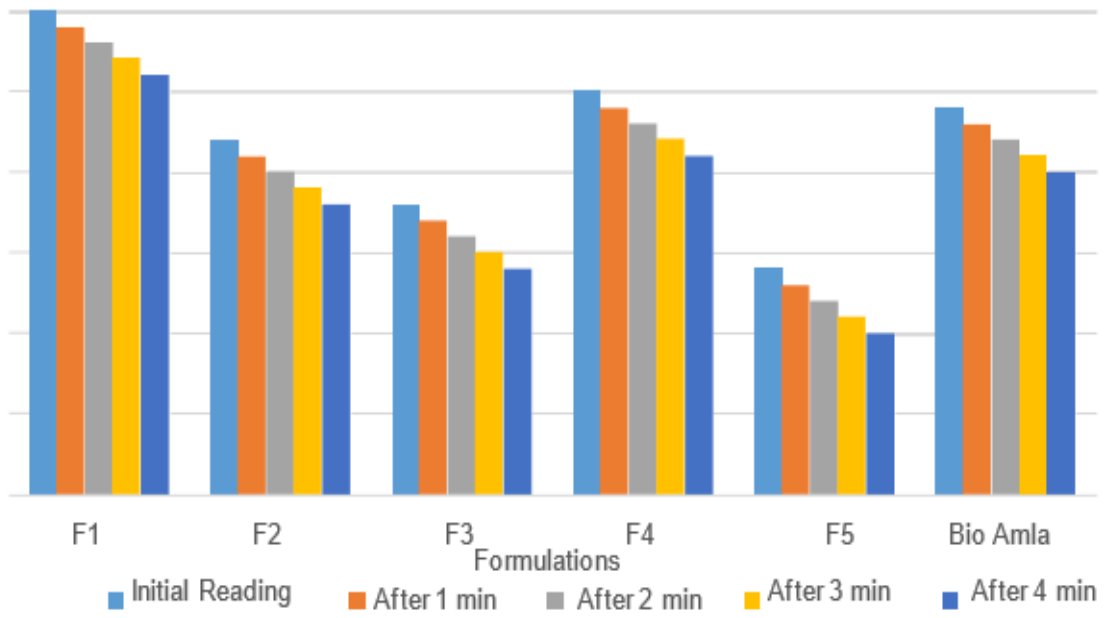

Figure 14: Graphical Representation of Foaming Ability

The skin irritation test was performed to check its effect on human scalp which reveals that the present formulations had no harmful effects on the scalp due to the absence of synthetic surfactants. Developed formulations F1, F3, F4 and F5 did not show any type of skin irritation as reported in Table 6.

The shampoo is considered as poor quality when the ink stayed in the foam, the dirt must be stayed in water. Dirt that concentrates in foam is difficult to rinse out and redeposit on hair. The results of the present formulation showed moderate dirt dispersion & good water solubility.

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Table 6: Determination of Dirt Dispersion, Solubility and Skin Irritation

Sr. No	Formulations	Parameters		
		Dirt dispersion	Solubility	Skin Irritation
1	F1	Moderate	Water soluble	No irritation
2	F2	Less Moderate	Sparingly soluble	Slight irritation
3	F3	Moderate	Water soluble	No irritation
4	F4	Moderate	Water soluble	No irritation
5	F5	Moderate	Water soluble	No irritation
6	Bio Amla	Moderate	Water soluble	No irritation

CONCLUSION

The purpose of this research was to formulate a polyherbal shampoo by using plant extracts. Use of harsh chemicals as in many of synthetic shampoos have direct and indirect adverse impact on scalp and hair. In present study a very useful medicinal plant was used *i.e., Moringa oleifera* as a major ingredient with a systematic combination of natural exfoliant, emulsifier, hydrating agent & preservative etc. All the physiochemical test performed predicted that these formulations successfully pass all tests and, in some parameters, performed even better. So polyherbal shampoo with *Moringa oleifera* as major ingredient can compete with any herbal shampoo available in market. It is 90% organic and free from any side effects.

Further research should focus on enhancing the **shelf stability** of the formulation through the incorporation of natural stabilizers or green preservatives. Investigations into the **antibacterial and antifungal efficacy** of the shampoo should also be expanded, possibly through the inclusion of additional phytochemicals or essential oils with known antimicrobial activity. Moreover, clinical trials could be conducted to validate its **dermatological safety and therapeutic efficacy** on various hair and scalp conditions. Consumer acceptability studies, **packaging innovations**, and **scaling up the production process** may also be explored to facilitate commercialization.

References

1) Patidar K. (2018) Development of polyherbal shampoo for antifungal activity and its comparison with commercially available shampoo. Asian Journal of Pharmaceutics, **12**(03), 112-115.

2) Sri, M. T., Divya, M. L., Sreevani, P., Tejaswi, S. S., Deepthi, S. V. R., Vandana, U., & Rao, N. R. (2021). Formulation and evaluation of fermented rice water herbal shampoo. Journal of Drug Delivery & Therapeutics, **11(4-S), 127-130**

3) Thapa, K., Poudel, M., & Adhikari, P. (2019). Moringa oleifera: A review article on nutritional properties and its prospect in the context of Nepal. Acta Scientific Agriculture 3(11), 47-54.

4) Leone, A., Spada, A., Battezzati, A., Schiraldi, A., Aristil, J., & Bertoli, S. (2016). Moringa oleifera seeds and oil: Characteristics and uses for human health. International journal of molecular sciences, 17(12), 2141-2145.

5) Nadeem, M., & Imran, M. (2016). Promising features of Moringa oleifera oil: recent updates and perspectives. Lipids in Health and Disease, 15, 1-8.

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6) Trüeb, R. M. (2009). Oxidative stress in ageing of hair. International journal of trichology, 1(1), 6-14.

7) Cretella, A. B. M., da Silva Soley, B., Pawloski, P. L., Ruziska, R. M., Scharf, D. R., Ascari, J., ... & Otuki, M. F. (2020). Expanding the anti-inflammatory potential of Moringa oleifera: topical effect of seed oil on skin inflammation and hyperproliferation. Journal of ethnopharmacology, 254, 112708-112712.

8) Park, J. H., Park, Y. J., Kim, S. K., Kwon, J. E., Kang, H. Y., Lee, E. S., ... & Kim, Y. C. (2016). Histopathological differential diagnosis of psoriasis and seborrheic dermatitis of the scalp. Annals of dermatology, 28(4), 427-432.

9) Toma, A., & Deyno, S. (2014). Phytochemistry and pharmacological activities of Moringa oleifera. International journal of pharmacognosy, 1(4), 222-231.

10) Guo, E. L., & Katta, R. (2017). Diet and hair loss: effects of nutrient deficiency and supplement use. Dermatology practical & conceptual, 7(1), 1-13

11) Coogan, P. F., Bethea, T. N., Cozier, Y. C., Bertrand, K. A., Palmer, J. R., Rosenberg, L., & Lenzy, Y. (2019). Association of type 2 diabetes with central-scalp hair loss in a large cohort study of African American women. International Journal of Women's Dermatology, 5(4), 261-266.

12) Vergara-Jimenez, M., Almatrafi, M. M., & Fernandez, M. L. (2017). Bioactive components in Moringa oleifera leaves protect against chronic disease. Antioxidants, 6(4), 91-96.

13) Patel, P., Patel, N., Patel, D., Desai, S., & Meshram, D. (2014). Phytochemical analysis and antifungal activity of Moringa oleifera. International Journal of Pharmacy and Pharmaceutical Sciences, 6(5), 144-147.

14) Abd Rani, N. Z., Husain, K., & Kumolosasi, E. (2018). Moringa genus: a review of phytochemistry and pharmacology. Frontiers in pharmacology, 9, 108-119.

15) Saraf, S., Hargude, S. M., Kaur, C. D., & Saraf, S. (2011). Formulation and evaluation of herbal shampoo containing extract of Allium sativum. Research Journal of Topical and Cosmetic Sciences, 2(1), 18-20.

16) Malpani, T., Jeithliya, M., Pal, N., & Puri, P. (2020). Formulation and evaluation of Pomegranate based herbal shampoo. Journal of Pharmacognosy and Phytochemistry, 9(4), 1439-1444.

17) Lodha, G. (2019). Formulation and evaluation of polyherbal shampoo to promote hair growth and provide antidandruff action. J Drug Deliv Ther, 9(4-A), 296-300.

18) Saripalla, D. D., Khokhani, N. D., Kamath, A., Rai, R. P., & Nayak, S. (2022). Organoleptic and physicochemical properties of natural-based herbal shampoo formulations with Cyclea peltata as a key ingredient. Journal of cosmetic dermatology, 21(4), 1666-1674.

19) Mangire S., (2020) Development and evaluation of biogenic AgNPs containing antidandruff shampoo. International Journal of Creative Research Thoughts (IJCRT), **8**(5), 3396-3403.

20) Utane, R., Deo, S., & Itankar, P. (2017). Preparation of herbal shampoo (HS) by green method and their characterization. International Journal of Researches in Social Sciences and Information Studies, 254, 258-262.