

Research Article

Formulation and upscaling of herbal shampoos by *Aloe vera* L. and *Camelia sinensis* L. powders

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Citation

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Abstract

The therapeutic benefits of medicinal plants for hair care have been acknowledged for centuries, with their use tracing back to ancient practices. This study focused on developing and evaluating a natural herbal shampoo using advanced formulation techniques, emphasizing safety and effectiveness as alternatives to synthetic components. The objective was to create a shampoo that not only cleanses but also strengthens, darkens, and promotes hair growth through advanced formulation techniques. Performance tests revealed a pH of 5.7, density of 0.9, viscosity of 1.96 ± 0.64 , and surface tension of 50.64 ± 4.21 , aligning with typical properties of herbal shampoos. Due to the absence of harsh chemicals, herbal shampoos typically exhibit higher surface tension and lower viscosity. The study concluded that this formulation offers a viable natural and safe alternative to synthetic shampoos for hair care. This research highlights the potential of medicinal plants in personal care and offers a foundation for further exploration to improve efficacy, stability, and sensory appeal for wider adoption in the hair care market.

Keywords: *Aloe vera*; *Camelia sinensis*; Evaluation; Formulation; Herbal shampoo

Introduction

Medicinal plants have long been recognized for their therapeutic effects on hair, and they are frequently incorporated into modern shampoo formulations [1, 2]. The use of herbs and medicinal plants dates back to ancient times, and their application in hair care has only grown in popularity [3, 4]. Shampoo, typically a liquid or cream, is used to cleanse the hair and scalp by removing sebum buildup, dirt, and residues from hair grooming products [5, 6]. Hair, a vital part of the body, originates from the outer layer of

skin and is connected to sweat and oil glands. Hair care products are designed not only to clean but also to alter the texture or color, nourish, and enhance the appearance of hair, contributing to a healthy and vibrant look [7, 8]. Herbal shampoos are cosmetic products derived from plant-based ingredients, offering a natural alternative to synthetic shampoos [9]. Unlike synthetic shampoos, which can be harsh on the skin, hair, and eyes, herbal shampoos are favored for their minimal adverse effects and cost-effectiveness [10]. The primary components

of shampoos include surfactant detergents, conditioning agents, active ingredients that promote hair growth, and additives that modify surfactant effects, such as viscosity control agents, foam stabilizers, and viscosity modifiers [11, 12]. To ensure the product's stability and appeal, preservatives, fragrances, and essences are also added, which are essential for maintaining the safety and efficacy of the shampoo [13]. *Aloe vera* is widely recognized for its numerous health benefits, including wound healing, burn treatment, skin protection from x-rays, and aiding in digestive issues [14]. Research suggests that *Aloe vera* can help mitigate the effects of sunburn, minor wounds, and even potentially prevent skin cancer. Due to its conditioning properties, *Aloe vera* is commonly included in shampoos and face cleansers. It promotes smoother, healthier hair while protecting against damage and addressing issues like dandruff, oil buildup, and lice infestation [15]. The antibacterial and antifungal properties of *Aloe vera* also help reduce dandruff, rebalance scalp pH, and stimulate hair growth [16]. *Camellia sinensis*, the plant source of green tea, is another beneficial ingredient in hair care products. Green tea is rich in antioxidants, which are known to enhance hair health among other benefits. These antioxidants can improve blood circulation, potentially increasing the oxygen and nutrient supply to hair follicles. Understanding the impact of green tea on hair thinning requires recognizing the primary causes of hair loss [17]. This study focuses on the development and evaluation of an herbal shampoo formulated with key ingredients such as *Embelica officinalis* (Amla), *Acacia concinna* (Shikakai), *Sapindus mukorossi* (Reetha), *Aloe barbadensis* (Aloe vera), and *Camellia sinensis* (Green tea) in various ratios [18]. Amla, in particular, is valued for its hair-strengthening properties, as well as its ability to prevent dandruff and hair fall. The primary

objective of this study is to prepare different formulations of herbal shampoo and evaluate their properties using various standard protocols.

Materials and Methods

Sample collection and identification

For the preparation of herbal shampoo, various plant varieties like *Embelica officinalis*, *Sapindus mukorossi*, *Acacia concinna*, *Aloe vera* and *Camellia sinensis* were collected from local market and were taken into Botany Department of Government College, University Lahore for identification (Fig. 1).

Chemicals required

The chemicals used included Acacia, Methyl paraben, Citric acid, Distilled water, Polyethylene glycol (PEG) 400, Glycerin, Castor oil, Coconut oil, Conditioner, Base.

Extraction of powders

Samples of *Embelica officinalis*, *Sapindus mukorossi*, *Acacia concinna* and *Camellia sinensis* were collected, shade dried and ground into fine powder. For extraction, 30g of each powdered plant was homogenized to 100g, boiled for 15-20 minutes, and extracted with distilled water and allowed to evaporate [19].

Formulation of herbal shampoo

Two different herbal shampoo formulations were prepared according to the proportion given in (Table 1) [20]. To enhance the formulation's thickness, measure and add 50ml of plant extract to the jar, adding each extract one by one. Add 10ml of each plant extract separately. 12ml of acacia solution, 5ml of methyl paraben solution, 20ml of Polyethylene glycol (PEG) 400, 12ml of glycerin, 30ml of conditioner, 15ml of castor oil, few drops of essential oil (e.g., rosemary oil), 2 ml of hydrolyzed keratin or wheat protein, and 0.5 ml of citric acid solution and 40ml of SLS base were added one by one into the glass jar. Use a stirrer to help you stir it. With the aid of the lid, seal the glass jar airtight. Herbal shampoo was prepared.

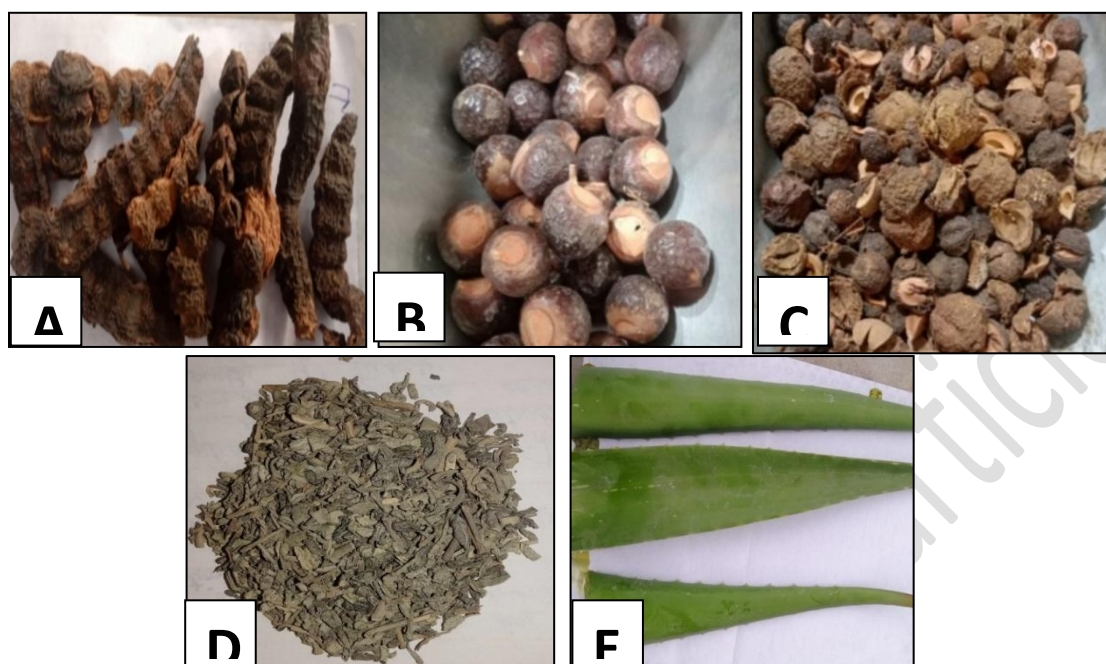


Figure 1A. Dried plant of *Acacia concinna* B. Dried plant of *Sapindus mukorossi* C. Dried plant of *Embelica officinalis* D. *Camelia sinensis* E. *Aloe vera* leaf

Table 1. Composition of formulated herbal shampoos

Sr. No.	Ingredient	(Quantities ml)		Properties
		F 1	F2	
1	Plants extract	50	40	Antioxidants
2	Acacia gum	12	7	Thickening and emulsifying agent
3	Methyl paraben	5	0.5	Preservative
4	Polyethylene glycol (PEG) 400	20	25	Conditioning agent
5	Glycerin	12	7	Softening agent
6	Shampoo base	40	15	Foaming agent
7	Conditioner	30	20	Shine and Smoothness
8	Castor oil	15	5	Hair Growth and Moisturization
9	Essential oil (rosemary oil)	2	2	Fragrance
10	Citric acid solution		0.5	Antioxidant/perservative
11	Hydrolyzed keratin/Wheat protein		2	Moisturization

Evaluation of herbal shampoo

Quality control tests, such as visual inspection and measurements of physicochemical parameters including pH, density, and viscosity, were carried out to assess the generated formulations.

Physical appearance evaluation and PH determination

The formulated shampoo was evaluated for foam production, color, aroma, fluidity, and clarity [21]. The pH of a 10% v/v shampoo solution in distilled water at room

temperature was measured with a calibrated pH meter [22, 23]. Herbal shampoos typically have a pH close to the natural hair pH (around 5.5), helping to maintain moisture balance, unlike some commercial shampoos, which may cause dryness or scalp issues due to higher or lower pH levels [24].

Viscosity evaluations

A Brookfield viscometer was used to measure the shampoos' viscosity [25]. The viscosity of the herbal shampoo was determined by counting the droplets from the mark to the bottom. Viscosity measures a shampoo's thickness and flow ability [26].

Surface tension measurement

Use distilled water to dilute the shampoo such that the concentration is 10% [27]. Measure the surface tension with a Stalegometer by drawing the sample to a mark and counting the droplets as it runs from point A to point B. Repeat with distilled water.

Density measurement

Take the empty pycnometer bottle, weigh it, 25cm fill it with shampoo, and then weigh the

bottle with the shampoo. Once more, add water to the pycnometer and weigh it and weigh the bottle with the marketed shampoo.

Skin irritation test

The skin was treated with the prepared herbal shampoo for five minutes, then it was washed and looked for indications of inflammation or skin irritation [28].

Foaming ability

The stability of the foam was assessed using the cylinder shaking method. A beaker containing 10 ml of a 10% herbal shampoo solution was covered and shaken vigorously by hand for ten minutes. After shaking, the total volume of foam produced was measured [29, 30].

Results and Discussion

Physical appearance

Formulated shampoo was opaque and dark brown in colour was shown in (Table 2). It has a pleasant scent from the smell of the components, and it can produce foam well (Fig. 2).

Table 2. Results

Samples	Formulations	Physical appearance	pH	Viscosity(cps)	Surface tension (dynes/cm)	Density g/ml
Herbal shampoo	F1	Light brown	5.7	1.96± 0.64	50.64±4.21	0.9
	F2	Dark brown	7.6	1.37±0.15	23.04±1.43	1.1
Market shampoo	F3	green	6.8	8.66±0.57	34.67±9.89	1.2
	F4	Green	6.8	8±1	33.13±11.33	1.0

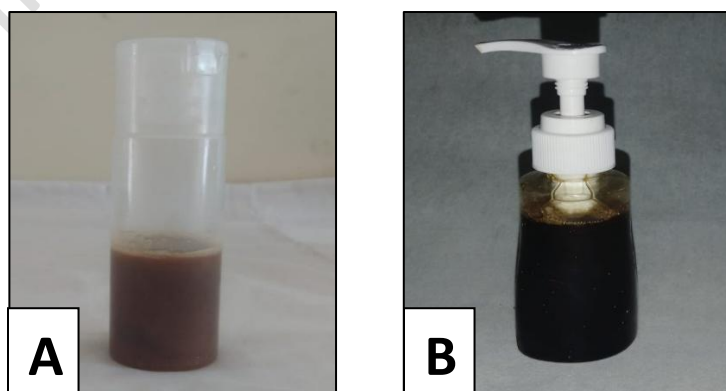


Figure 2A. 1st herbal shampoo formulation B. 2nd Herbal shampoo formulation

pH

The pH of the herbal shampoo was tested with a 10% distilled water solution [31]. The herbal shampoo's pH values were 5.7 and 7.6 for the first and second formulations, respectively, both within the ideal range of 5 to 7.6. In comparison, the marketed Bio Amla shampoo had a higher pH of 6.8. Lower pH shampoos are trending for reducing hair damage and irritation [32].

Surface tension

The surface tension of clean water should be reduced by a good shampoo to around 40

dynes/cm [33, 34]. The herbal shampoos' good detergent effect is demonstrated by the decrease in water's surface (Fig. 3).

Viscosity

The viscosity evaluation showed that the shampoo's thickness changes as the speed of mixing increases, indicating that the shampoo's properties are time dependent [35]. To test viscosity of surface tension, a viscometer is used. The viscosity of herbal shampoo and market shampoo can be determined by counting the number of drops (Fig. 4) [36].

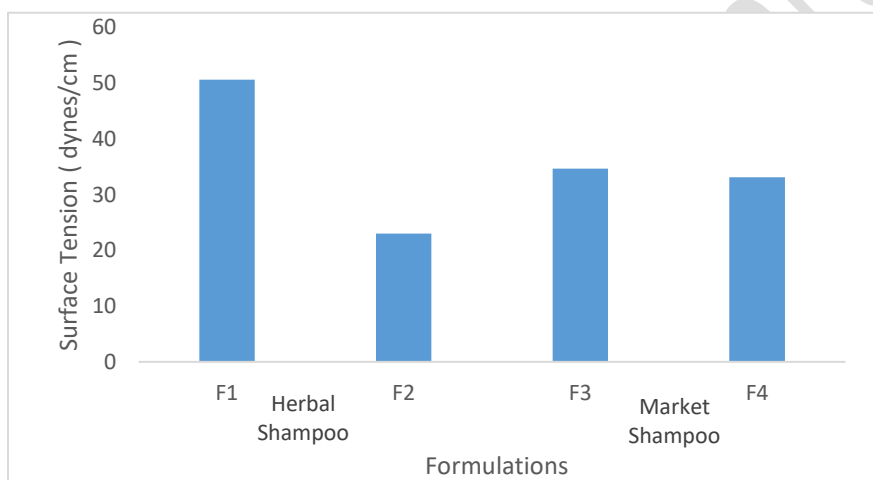


Figure 3. Comparison of Surface tension of herbal and marketed shampoo

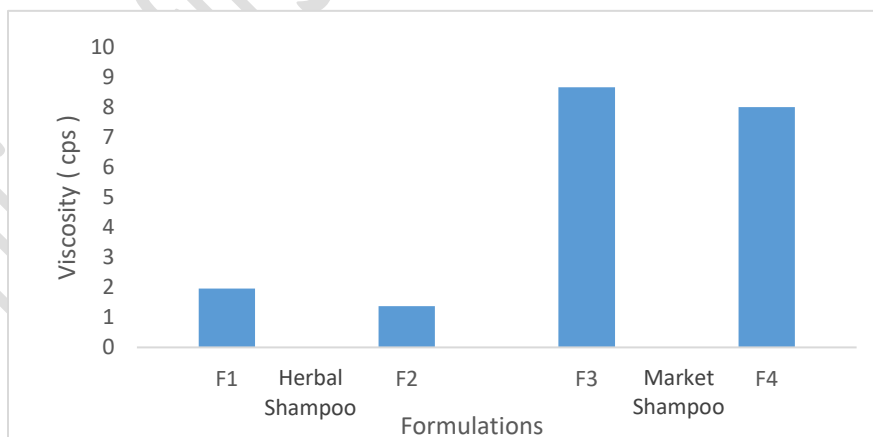


Figure 4. Comparison of viscosity of herbal and marketed shampoo

Density

To find the density pycnometer bottle, also weigh the density of water, density of formulated shampoo and density of marketed shampoo (bioamla). The density values were provided in the first and second formulations.

Skin irritation test

After being applied to the skin, our shampoo does not cause any sensitive reactions. It doesn't do harm. There was no skin swelling or Redding seen in the observations. Furthermore, there were no itchy feelings (Fig. 5) [37].

Foaming ability

Foam stability is a crucial characteristic of shampoo. An essential aspect of the shampoo

evaluation was the measurement of foaming stability. The shampoo formulation produced more than 50 milliliters of foam, which remained consistent for approximately five minutes, indicating that the foam generated has good stability.

Cleaning action

Human hair, oiled and unwashed for seven days, demonstrated the shampoo's strong cleaning power, removing oil and dirt (Fig. 5). Its conditioning properties also enhanced hair softness and luster. People around 24 years old used this shampoo for about a week. After using it, the shampoo had a very positive effect on their hair, making it soft and shiny.



Figure 5. Skin irritation test

Conclusion

The present study aims to prepare an herbal shampoo that strengthens hair development and decreases hair loss while combing. It is also safer than chemical conditioning agents. The aqueous extract of medicinal herbs, which are historically used to cleanse hair, was utilised to produce herbal shampoo. The use of synthetic conditioning treatments lowers protein or hair loss. In place of artificial cationic conditioners, plant extracts such as Shikakai, amla, reetha, and others are used in this study to produce the desired conditioning results. This investigation's primary goal was to create a stable, functionally effective shampoo without the

use of any kind of synthetic ingredients, which are often included in such formulations. Numerous testing was carried out to assess the produced shampoo's good product performance. For quality control tests, the results of the evaluation study of our manufactured shampoo were comparable to those of marketed shampoo; however, further research and development are required to increase the product's overall quality.

Authors' contributions

Conceived and designed the experiments: A Fatima & U Hanif, Performed the experiments: A Fatima, Analyzed the data: A Fatima, R Shafique, H Yaqoob, R Aziz, A Maqsood, H Hanif & A Mustafa, Contributed

materials/ analysis/ tools: Microscope, Plants, Methyl Paraben etc.: A Fatima, H Yaqoob, R Aziz & A Mustafa, Wrote the paper: A Fatima.

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References

1. Shen YL, Li XQ, Pan RR, Yue W, Zhang LJ & Zhang H (2018). Medicinal plants for the treatment of hair loss and the suggested mechanisms. *CurrPharma Design* 24(26): 3090-3100.
2. Arora P, Nanda A & Karan M (2011). Shampoos based on synthetic ingredients vis-a-vis shampoos based on herbal ingredients: a review. *Inter J of Pharma Sci Rev and Res* 7(1): 41-46.
3. Aziz R, Hanif U, Zafer N, Fatima S & Lashari A (2023). Investigation of adulteration in some medicinal plants used for the treatment of Covid-19. *Pure and Appl Biol* 12(2): 1000-1008
4. Zafar N, Hanif U, Aziz R, Mustafa A & Asghar,A (2023). Microscopic Authentication of Weeds of Rice Fields Collected from Adjoining Areas of District Kasur. *GU J of Phytosci* 3(4): 247-255.
5. Fatima GX, Rahul RS, Sowmya KV, Reshma I & Shanmuganathan S (2015). Development and evaluation of a polyherbal shampoo. *Adv J Pharm Life Sci Res* 3(1): 13-16.
6. Dureja H, Kaushik D, Gupta M, Kumar V & Lather V (2005). Cosmeceuticals: An emerging concept. *Indian J of Pharmacol* 37(3): 155-159.
7. Aghel N, Moghimipour E & Dana AR (2008). Formulation of herbal shampoo using total saponins of *Acanthophyllum squarrosum*.
8. Snehal W & Nitin K (2014). Preparation & evaluation of antidandruff polyherbal powder shampoo. *Pharma* 5(1-2014): 77-84.
9. Reddy VS, Reddy DJK & Velu MG (2016). Formulation and evaluation of antidandruff shampoo. *J Pharm Res* 10: 700-702.
10. Pandey A & Singh S (2016). Aloe Vera: A Systematic Review of its Industrial and Ethno-Medicinal Efficacy. *Inter J of Pharma Res & All Sci* 5(1).
11. Patel NR, Mohite SA & Shaha RR (2018). Formulation and evaluation of onion hair nourishing shampoo. *J of Drug Del and Therape* 8(4): 335-337.
12. Kumar PP, Priyanka N, Subrahmanyam MG, Kumar KA, Venkat AE, Sangeetha V & Sirisha D (2024). Formulation and evaluation of herbal shampoo. *J of Pharma and Phytochem* 13(2): 165-170.
13. Tarun J, Susan J, Suria J, Susan VJ & Criton S (2014). Evaluation of pH of bathing soaps and shampoos for skin and hair care. *Indian J of Dermatol* 59(5): 442-444.
14. Ashwini VJ, Dipak M, Daundekar A, Bhujbal N & Kshirsagar S (2018). Herbal Hair Cosmetics-An Overview. *World J of Pharm Sci* 6(9): 144-152.
15. Jamil M, Mansoor M, Latif N, Naz R, Anwar F, Arshad M & Saddam M (2020). Review Effect of Aloe vera on Wound Healing: Review: Effect of Aloe vera on Wound Healing. *Biol Sci-PJSIR* 63(1): 48-61.
16. Sahu PK, Giri DD, Singh R, Pandey P, Gupta S, Shrivastava AK & Pandey KD (2013). Therapeutic and medicinal uses of Aloe vera: a review. *Pharmacol & Pharma* 4(08): 599.
17. Lin, J, Zhang S, Hu Y *et al.* (2013). *Camellia sinensis*: a new treatment for hair loss? *Evid Based Comp Alt Med* 2013: 589412.

18. Al Badi K & Khan SA (2014). Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoos. *Beni-Suef Uni J of Basic and Appl Sci* 3(4): 301-305.
19. Khushboo PS, Jadhav VM, Kadam VJ & Sathe NS (2010). *Psoralea corylifolia* Linn. — “Kushtanashini”. *Pharma Rev* 4(7): 69.
20. Yamani NS, Pratyusha K & Pratyusha J (2018). Formulation and evaluation of polyherbal hair oil. *J of Pharma and Phytochem* 7(3): 3254-3256.
21. Dash GK & Razak NHNBA (2017). Formulation and evaluation of a herbal shampoo. *Indo Am J of Pharma Sci* 4(9): 2860-2865.
22. Bassett IB, Pannowitz DL & Barnetson RS (1990). Tea-tree oil versus benzoyl peroxide in the treatment of acne: a comparative study. *The Med J of Aus* 153(8): 455-8.
23. Reddy VS, Reddy DJK & Velu MG (2016). Formulation and evaluation of antidandruff shampoo. *J Pharm Res* 10: 700-702.
24. Dash GK & Razak NHNBA (2017). Formulation and evaluation of a herbal shampoo. *Indo Am J of Pharma Sci* 4(9): 2860-2865.
25. Sekar M & Merican HAMNN (2016). Formulation and evaluation of herbal shampoo containing rambutan leaves extract. *Inter J of Pharma and Biol Sci* 7(4): P146-P151.
26. Meshram DB, Krunali T, Dhara P & Mitesh, P (2013). Evaluation of standards of some selected shampoo preparation. *J Pharma Pharm Sci* 2(5): 3622-3630.
27. Pundkar AS & Sujata P (2020). Formulation and evaluation of herbal liquid shampoo. *World J of Pharma Res* 9(5): 901-911.
28. Mainkar & Jolly (2000). Evaluation of commercial herbal shampoos. *Inter J of Cosm Sci* 22(5): 385-391.
29. Shakeena D, Selophy R, Pushpalatha M & Hepsiba J (2021). Formulation and evaluation of aloe vera gel shampoo. *Inter J of Pharma and Drug Ana* 9(3): 172-179.
30. Klein K (2004). Evaluation of shampoo foam. *Cosmet Toilet Mag* 119: 32-35.
31. Dias MFRG, de Almeida AM, Cecato PMR, Adriano AR & Pichler J (2014). Shampoo pH can affect the hair: myth or reality? *Inter J of Trichol* 6(3): 95-99.
32. Kumar PV, Rao PV, Prince R, Terejamma K, Chaitanya T & Desu PK (2018). Formulation and evaluation of herbal antidandruff shampoo from bhringraj leaves. *ARC J of Pharma Sci* 4(2): 29-33.
33. Ireland S, Carlino K, Gould L, Frazier F, Haycock P, Ilton S, Deptuck R, Bousfield B, Verge D, Antoni K, MacRae L, Renshaw H, Bialachowski A, Chagnon C & Reddy K (2007). *Can J Neurosci Nurs* 29(1): 14-9
34. Kameswararao K, Lakshmi prasanna B, Aparnadevi M, Nagadevi G & Rajeswari S (2018). Formulation and evaluation of polyherbal shampoo. *Inter J Pharm Pharm Sci* 13: 251-268.
35. Reddy VS (2018). Formulation and evaluation of synthetic anti-dandruff shampoo. *Asian J of Pharma (AJP)* 12(01).
36. Halligudi N & Al-Khudori MS (2013). Evaluation of cosmetic properties of different brands of shampoos from multinational brands in Oman. *J of Drug Dis and Therape* 1(7): 91-6.
37. Malpani T, Jeithliya M, Pal N & Puri P (2020). Formulation and evaluation of Pomegranate based herbal shampoo. *J of Pharma and Phytochem* 9(4): 1439-1444.