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Review Article

An overview on Formulation and Development of Herbal Shampoo

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ABSTRACT

Recent developments in hair science and hair care technologies have introduced innovations and strategies for hair treatment and cosmetic products. Traditionally, hair and scalp care involved the use of shampoo for effective yet gentle cleansing. However, shampoo has evolved beyond a mere cleansing product, now also contributing to the health and beauty of hair by adding shine and improving manageability. Herbal Shampoo, a natural hair care product, is designed to eliminate grease, dirt, dandruff, and promote hair growth, strength, and darkening. It also imparts softness, smoothness, and shine to the hair. The preparation of cosmetic shampoos involves various ingredients, some of which may have side effects such as hair loss, increased scaling, itching, discomfort, nausea, and headaches.

INTRODUCTION

From ancient time beyond memory, mankind has been borrowing abundantly from nature to care for their health, skin and hair, as natural ingredients that have preventive, protective and corrective action. The warehouse of cosmetics, nature provides such versatile natural ingredients that enhance beauty of the skin and hair. Hair cosmetics are an important tool that helps to increase patient's adhesion to alopecia and scalp treatments. Shampoos are not only scalp cleaners, but indubitably act as preventing the hair shaft damage. Many scalp diseases are also treated by active ingredients that are added to the shampoo's formulations. It is desirable that whatever may the disease or condition be (dermatitis, seborrhea, alopecia, psoriasis), the hair strands are kept aesthetically presentable, preserving its softness, combability and shine while treating the scalp [1]. Now a day's peoples are conscious about hairs due to increase in pollution hairs get damaged. Pollutants badly effects on hair resulted into spilt ends, roughness, retarded growth of hairs, loss of shine of hair and hair falls. These all problems of

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hair are covered by shampoo but in case of synthetic shampoos they are made from chemical constituents shows side effects on hairs.

❖ **Hair:**

Hair is an integral part of the body, serving as a protective feature of the integumentary system alongside sebaceous glands, sweat glands, and nails. These structures, collectively known as epidermal derivatives, originate from the skin's ectoderm during embryological development.

Hair is composed of three main parts: the bulb, the root, and the stem, and it is situated within the pilosebaceous follicle in the dermis. The bulb, located at the deepest end of the hair, is responsible for its growth and is connected to the well-nourished dermal papillae, ensuring the supply of essential nutrients for hair growth.

The root is firmly anchored within the hair follicle and transitions into the stem, the visible part of the hair that extends beyond the skin's surface. Both the root and stem consist of three layers: the medulla, the cortex, and the cuticle. The cortex, the largest and thickest part, influences many mechanical properties of the hair, comprised of spindle-shaped cortical cells filled with keratin filaments oriented parallel to the hair shaft's axis. Crosslinking through covalent disulfide bonds between adjacent keratin chains, particularly the cysteine residues, contributes to the hair's shape, stability, and texture [2].

The cuticle, made up of resistant layers of overlapping dead cells, forms a protective shield against external environmental factors. It is divided into the endocuticle and exocuticle and is responsible for the hair's shine and texture, as well as minimizing friction between hair shafts through its smooth appearance and light-reflective properties.

The cuticle is comprised of three distinct layers: the b-layer, a-layer, and epicuticle. The epicuticle, described by Hordinsky et al., is a hydrophobic lipid layer consisting of 18-methyleicosanoic acid, which covers the hair's surface, including the f-layer that overlaps cuticle cells surrounding the elongated polyhedral cortical cells. The interaction between this outer hydrophobic layer and the cortex contributes to the physical properties of hair shine and volume, which are vital for the appearance of "healthy hair." When hair undergoes damage due to friction or exposure to chemicals that remove the f-layer, its first hydrophobic defense, the hair fiber becomes significantly more fragile.

It's worth noting that hair fibers contain a variety of components, including sulfur-rich proteins, lipids, water, melanin, and trace elements. Keratin is the primary constituent of hair, being a fibrous and durable protein. Its amino-acid chains are structured in an α helix and predominantly consist of tyrosine, glycine, and cysteine. Keratin can exist in acidic, neutral, and basic forms[3].

❖ **Hair Care:**

Hair texture and shine are typically associated with surface properties, while the overall structural integrity of hair is primarily attributed to the hair cortex. To enhance these aspects, various hair products have been developed, including those that reinforce the structural integrity of hair fibers, increase tensile strength, boost volume, reduce

frizz, enhance manageability, and even stimulate new hair growth.

Modern cosmetic products are designed with the aim of not only cleansing the hair from impurities but also restoring and enhancing its physiological condition. For instance, intensive conditioning agents can temporarily act as a substitute for the f-layer, enhancing moisture retention in the cortex and partially restoring some of the hair's diminished physical properties. Consequently, achieving shinier hair is a significant advantage of these modern products [4].

❖ **Shampoo:**

Shampoo is a product containing surfactants, available in various forms such as liquid, solid, or powder. When used as intended, it should efficiently and harmlessly eliminate surface grease, dirt, and skin debris from the hair without causing any negative effects on the user.

The ideal characteristics of shampoo include its ability to effectively and completely remove dust and excess sebum, efficiently cleanse the hair, generate a rich lather, rinse out easily with water, leave the hair soft, glossy, and manageable, infuse a pleasant fragrance, and not have adverse effects on the skin or eyes. Moreover, it should not lead to rough or chapped hands [5].

- **Types of Shampoo:**

Shampoo comes in various forms, each with its unique characteristics:

1. Liquid shampoo
2. Solid cream shampoo
3. Jelly shampoo
4. Powder shampoo
5. Lotion shampoo
6. Aerosol foam shampoo

Additionally, there are specialized shampoos designed for specific purposes:

1. Conditioning shampoo
2. Antidandruff shampoo
3. Baby shampoo
4. Two-layer shampoo

These variations cater to different hair care needs and preferences [6].

- **Composition of Shampoo:**

1. Principal surfactant
2. Secondary surfactant
3. Antidandruff agents
4. Conditioning agents
5. Pearlescent agents
6. Sequestrants
7. Thickening agents
8. Colors, fragrances, and preservatives

These ingredients work together to cleanse, condition, and enhance the overall performance and appeal of the shampoo [7].

❖ **Herbal Shampoo:**

Shampoos are one of the most commonly used cosmetic products for cleansing the hair and scalp in our daily routines. Herbal shampoos are cosmetic formulations designed to clean the hair and scalp, similar to regular shampoos, but they incorporate traditional Ayurvedic herbs. These herbal shampoos are employed to remove oils, dandruff, dirt, and environmental pollutants.

Herbal shampoos are gaining prominence as an alternative to synthetic shampoos available in the market [8]. This shift is driven by the increasing preference for herbal products over chemical ones due to their perceived health-enhancing qualities. There is a growing awareness of and demand for herbal cosmetics because they are believed to be safe and free from undesirable side effects.

- **Characterization of Herbal Shampoo:**

Here are the procedures for two tests related to shampoo evaluation:

1. pH Measurement:

- A 1% shampoo solution was prepared and used to measure its pH by employing a pH meter [9].

2. Solids Percentage Determination:

- The initial weight of a clean and dry evaporating dish was recorded. Then, 4 grams of the shampoo formulation (not the 1% solution) was placed in the evaporating dish. The dish, along with the shampoo, was weighed, and the initial weight of both the dish and shampoo was recorded. The exact weight of the shampoo alone was calculated and its initial weight was noted. Subsequently, the evaporating dish containing the shampoo was heated on a hot plate until the liquid component had evaporated. After drying, the dish and the shampoo solids were weighed, and the results were recorded. This procedure allowed for the determination of the percentage of solids in the shampoo formulation [10].
- Here are the steps for evaluating foam-related characteristics of the shampoo:

3. Foam Formation (Shake Test):

- Begin by taking 50 ml of the 1% shampoo solution in a 250 ml graduated cylinder and note the initial volume [11].
- Cover the cylinder with your hand and shake it vigorously ten times.
- After shaking, record the total volume of the contents and make note of the bubble size that formed.

4. Foam Quality and Retention:

- Immediately after the shake test, start a timer and record the time.
- Then, at 1-minute intervals, record the volume of foam for a total of 5 minutes. This will help assess the quality and how well the foam is retained over time [12].

❖ **Here are the procedures for additional tests related to shampoo evaluation:**

5. Surface Tension Assessment:

- A 1% v/v solution of the shampoo was prepared by mixing 2 ml (equivalent to 40 drops) of shampoo with 200 ml of distilled water.
- The shampoo was placed in a beaker, and distilled water was gradually added while thoroughly mixing the shampoo and water.
- Surface tension was determined using a stalagmometer.

6. Skin Irritation Test:

- The solution of the prepared shampoo was applied to the skin and left in place for 5 minutes [13].
- Observations were made for any signs of skin redness or irritation. No redness or irritation was observed.

7. Visual Stability Assessment:

- The prepared shampoo was subjected to a visual stability test for 21 days at room temperature with a relative humidity of 65 ± 5.
- Observations were made for any changes in color and pH during this period. No changes in color or pH were noted within the 21-day period, and there was no phase separation between the oil and water components of the shampoo [14].

8. Viscosity Measurement:

- Viscosity was determined using an Ostwald viscometer.

9. Dirt Dispersion Test:

- Two drops of cleanser were added to 10 ml of refined water in a wide-mouthed test tube.
- To the formulated shampoo, one drop of Indian ink was added and the test tube was sealed with a stopper.

- The contents were shaken for 10 minutes, and the volume of ink in the foam was measured and categorized as none, slight, medium, or heavy dispersion [15].

10. Wetting Time Assessment:

- Wetting time was calculated by noting the time it took for a canvas paper disc (0.44 g, 1-inch diameter) to sink completely when placed over the shampoo.

11. Visual Assessment:

- The prepared formulation was visually evaluated for color, clarity, odor, and foam content [16].

12. Conditioning Performance Evaluation:

- To assess the conditioning effect of the optimized polyherbal shampoo (F4) and compare it with a commercial shampoo, a hair tress from an Egyptian woman was obtained.
- The hair tress was cut into three swatches, with one remaining unwashed as a control.
- The other two swatches were washed with the optimized polyherbal shampoo formulation (F4) and the commercial shampoo [17].
- Twenty-five blindfolded female volunteers assessed the conditioning performance of the tested shampoos based on smoothness and softness using a tactile test, rating them from * (poor) to ** (excellent).

13. Microbial Control Assessment:

- Soybean-casein Digest Agar Medium (SCDA) was used for the preliminary evaluation of microorganisms.
- Microbial suspensions at concentrations of 10^5 and 10^8 for strains of Candida albicans, Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus were prepared.
- A sample of shampoo was diluted with SCDA at a 1:10 ratio.
- Then, 1 ml of the prepared diluted solution was added to 9 ml of SCDA in four test tubes.
- ml of each microbial suspension was added individually to one of the corresponding test tubes.
- The test tubes were sealed, shaken, and incubated at 37°C for 24 hours [18].

14. Microbial Limits Test:

- This test was performed using the plate count method.
- Various dilutions (1:10, 1:20, 1:30, 1:40, and 1:50) of the diluted licorice shampoo were prepared.
- 1 ml of each dilution was added to five test tubes containing 9 ml of SCDA.
- Then, 1 ml of the mixture from each test tube was plated on a nutrient-agar and melted agar plate, which was then incubated for 24 hours [19].

15. Antimicrobial Preservative Effectiveness Test:

- 20 ml of licorice shampoo and 0.1 ml of each microbial suspension were combined in individual test tubes.
- These test tubes were kept at room temperature for various time intervals (7, 14, 21, 28, and 35 days for Candida albicans).
- 1 ml of the contents from each tube was placed on two sterile plates, and 40°C melt soybean-casein digest agar was added to them.
- After solidification, they were incubated at 37°C for 24 hours [20].

16. Evaluation of Consumer Satisfaction:

- 50 volunteers were given the licorice shampoo to use for 30 days, with ethical approval.
- Volunteers aged 25–35, living locally, were instructed on shampoo usage and advised not to use other shampoos during the trial.
- After the trial, volunteers filled out a questionnaire covering various aspects related to the shampoo, including its quality, impact on hair, scalp, and eyes, as well as its effects

on hair complications like itching, dandruff, and more [21].

- The consumers rated different aspects of the shampoo as excellent, good, or bad in the questionnaire.

❖ **Evaluation of herbal powder shampoo:**

Here are descriptions of various tests related to the properties of a substance:

1. Solubility Assessment:

Solubility refers to a substance's ability to dissolve in a solvent.

A precise measurement of one gram of the powder is taken and transferred into a beaker containing 100 ml of water.

The mixture is thoroughly shaken and gently heated to enhance solubility [22].

After cooling, the solution is filtered, and the weight of the residue is recorded.

2. Loss on Drying Measurement:

Loss on drying is a percentage expression of the mass lost.

Two grams of the powder are accurately weighed and placed into a dry Petri dish.

The Petri dish is then positioned in a desiccator for two days, using calcium chloride crystals.

The powder is subsequently weighed accurately to determine the weight loss during the drying process.

3. Swelling Index Determination:

The swelling index measures the volume, in milliliters, occupied by one gram of a substance, along with any adhering mucilage, after it has swollen in an aqueous liquid for four hours.

One gram of the powder is accurately weighed and placed in a glass stopper measuring cylinder containing 25 ml of water.

The mixture is shaken thoroughly every 10 minutes for an hour, followed by a three-hour rest at room temperature.

The volume, measured in milliliters, is recorded [23].

The angle of repose is the maximum angle between the surface of a pile of powder and the horizontal plane.

Two methods are used to determine the angle of repose:

I. Funnel Method:

A specified quantity of dry powder is placed in a funnel positioned 6 cm above a horizontal base.

The powder flows to create a heap on a horizontal surface, and measurements are taken for the heap's height and radius [24].

II. Open-ended Cylinder Method:

A specific amount of dry powder is loaded into a cylindrical tube open at both ends and placed on a flat surface.

The funnel is raised to create a heap, and measurements are recorded for the heap's height and radius.

- **Bulk Density:**

Bulk density is the ratio of a given mass of powder to its bulk volume.

The required amount of powder is dried and filled into a 50 ml measuring cylinder up to the 50 ml mark.

The cylinder is dropped onto a hard wood surface from a height of 1 inch at 2-second intervals.

The volume of the powder is measured, and its weight is recorded. This process is repeated to obtain average values [25].

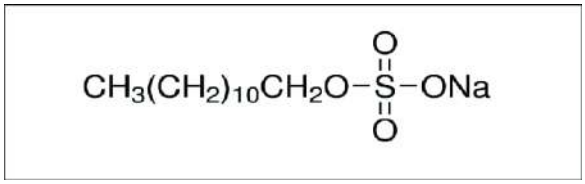
- **Foaming Index:**

One gram of the powder is accurately weighed and transferred into a 250 ml conical flask containing 100 ml of boiling water.

The mixture is gently warmed for 30 minutes.[25]

❖ **Side effects of various chemicals used in commercial shampoos:**

➢ **Sodium lauryl sulfate (SLS),**



Commercial shampoos commonly found in stores often contain chemicals that may have adverse effects, such as Sodium Lauryl Sulfate (SLS).[26] Sodium lauryl sulfate (SLS), also known as sodium laureth sulfate, is a particularly concerning chemical commonly found in most shampoos. It is derived from sulfuric acid, monododecyl ester, and sodium salt. SLS has the capability to be absorbed through the skin, potentially accumulating in various organs, including the brain and heart, over extended periods of use, which can lead to harm. Furthermore, if SLS is contaminated, it may contain dioxane, a known carcinogen (Black and Howes, 1979).[26]

❖ **Harmful effects of sodium lauryl sulphate:**

- **Skin Irritant:**

Sodium lauryl sulfate (SLS) is a well-known skin irritant, to the extent that it serves as the universal standard for testing the irritation potential of other chemicals in clinical studies. Even at low concentrations of 0.5%, SLS can cause irritation, while many products use a much higher 30% SLS solution for testing purposes (Cowley and Farr, 1992).[26]

- **Eye Irritant:**

Shampoo tends to come into contact with the eyes during use, and if it contains SLS, it has the potential to inflict permanent damage to the cornea[26]

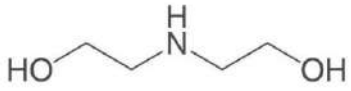
- **Hormone Imbalance:**

SLS, when absorbed through the skin, can disrupt hormonal balance in the body. It can interfere with the proper regulation of the estragon hormone by binding to estrogen receptors. In women, this can result in menstrual irregularities and potential fertility issues. In men, SLS may lead to elevated estrogen levels, contributing to conditions like breast enlargement, reduced sperm count, impaired sperm mobility, and a decrease in testosterone levels (Agner et al., 1989). [26]

- **Cancer Causes**:

SLS has been associated with the potential to cause cancer by damaging cellular proteins. During the SLS process, it generates nitrates, which can be absorbed through the skin and lead to substantial harm over time. Additionally, SLS is known to induce mutations in the genetic material within our cells, as suggested by Lee and Maibach in 1995.[26]

❖ **Diethanolamine or DEA:**



DEA (diethanolamine) and its derivatives, like cocamide DEA, are commonly found in bath products. Research, including a study conducted by Dr. Samuel Epstein, a prominent toxicologist from the University of Illinois, has raised concerns about the potential health risks associated with DEA. Dr. Epstein testified that DEA could be.a. potential carcinogen and that even repeated use of small amounts may increase the risk of cancer. [27]

❖ **Side effects of Diethanolamine:**

- **Acute Effects:**

▪ Acute inhalation exposure to diethanolamine in humans may result in irritation of the nose and throat, and dermal exposure may result in irritation of the skin.

▪ Animal studies indicate that exposure to diethanolamine by intravenous injections can cause increased blood pressure, pupillary dilatation, and salivation.\

▪ At very high doses in animals, sedation, and coma may. Result.

▪ Acute animal studies have shown that dermal exposure to diethanolamine may burn skin,

and eye contact. With the chemical may impair vision.

- Acute animal tests in rats have shown diethanolamine to have moderate acute toxicity from oral exposure.[28].

❖ **Chronic Effects (Noncancer):**

- **Noncancer:**
- **No information is** available on the chronic effects of diethanolamine in humans.
- Animal studies have reported effects on the liver, kidney, blood, and CNS from chronic oral exposure to. Diethanolamine.
- Skin lesions were observed in mice following daily topical administration of diethanolamine.
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for diethanolamine.
- The California Environmental Protection Agency (CalEPA) has established a chronic reference exposure level. Of 0.02 milligrams per cubic meter (mg/m) for diethanolamine based on effects on the blood in rats.
- The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to. Occur. It is not a direct estimator of risk but rather a reference point to gauge the potential effects.[28]
- **Reproductive/Developmental Effects:**
- No information is available on the reproductive or developmental effects of diethanolamine in humans.
- Animal studies have reported testicular degeneration and reduced sperm motility and count from oral. Exposure to diethanolamine.[28]
- **Cancer Risk:**
- No information is available on the carcinogenic effects of diethanolamine in humans.
- The NTP reported an increased incidence of liver and kidney tumours in mice and no increased incidence in
- rats from dermal exposure to diethanolamine. (4)
- EPA has not classified diethanolamine for carcinogenicity.[28]

❖ **Beneficial herbal ingredients in natural shampoos:**

The demand for cosmetics and shampoos containing herbal ingredients has increased significantly. This trend is driven by the belief that such products are safe and come with minimal side effects. Nowadays, the market offers a wide variety of herbal shampoos enriched with plant extracts and essential oils. Numerous plant-based ingredients have been identified for their beneficial effects on hair and are commonly utilized in shampoo formulations.[29]

1. Aloe Vera:

Aloe Vera's enzymes have been found to effectively dissolve dead skin cells and excess sebum, preventing hair follicle clogging. Aloe also contains salicylic acid, which has anti-inflammatory and mild antibiotic properties. The molecular structure of aloe gel closely resembles keratin, a key protein in skin and hair composition. Therefore, aloe Vera is a beneficial choice for promoting hair growth, as suggested by Mainkar and Jolly in 2001.[30]

2. Punicagranatum.L:

Belonging to the Punicaceae family, Punicagranatum L. has a long history of use in treating various ailments, particularly dandruff and scalp inflammation. This plant contains a range of chemical constituents, including citric acid, ellagic acid, ellagitannins (such as punicalagins), luteolin, β-sitosterol, icosanoic, linolenic, malic acid, protocatechuic acid, chlorogenic acid, caffeic acid, ferulic acid, coumaric acid, anthocyanins, flavonoids, polyphenols, and tannins.

These chemical compounds have demonstrated various pharmacological properties, such as anti-dandruff, anti-inflammatory (inhibiting pro-inflammatory cytokines), anti-itching, and antioxidant effects in multiple studies. They have also shown inhibitory effects on enzymes like cyclooxygenase (COX), lipoxygenase (LOX), and phospholipase A2 (PLA2). These properties make Punicagranatum L. a valuable ingredient in shampoos, as COX and LOX are key enzymes involved in the production of prostaglandins and leukotrienes, which contribute to inflammation. Furthermore, ellagic acid, phenolic acid, and tannin found in the plant have anti-dandruff, antifungal, and antimicrobial properties, as noted by Barel et al. in 2001.[30]

3. Rosmarinus officinalis L.:

Rosmarinus officinalis, native to the Mediterranean and a member of the Lamiaceae family, contains a range of chemical compounds, including 1,8-cineole (15 - 55%), camphor (5 - 31%), β and α-pinene (9 - 26%), tannic acid, resin, flavonoids, and various volatile oils such as lomonene (1.5 - 5%), borneol (1.5 - 5%), comphene (2.5 - 12%), and cineole.

This plant possesses properties that can reduce fatty acid peroxidation and inhibit fungal growth, particularly in a pH range of 5 -6 through membrane damage. It is traditionally used as an effective antifungal and antibacterial ingredient. Additionally, the methanolic extract of R. officinalis displays antioxidant qualities due to the presence of phenolic compounds, Rosmarinus acid, flavonoids, natural pigments like capsaicin and curcumin, as well as terpenes including carnosic acid and carnosol.

A study conducted by Ravichandran et al. in 2004 concluded that formulations containing R. officinalis are effective due to the synergistic actions of its ingredients, providing antifungal, anti-inflammatory, and local immunostimulatory effects. These formulations are considered safe for managing dandruff.[31]

4. Ziziphusspina cristi (Christ Thorn Jujube):

The Ziziphus spina-christi tree, commonly referred to as Sidr in Arabic, is native to the Middle East, including Oman. Traditionally, women have used its leaves for hair care, achieving results like hair darkening, lengthening, and thickening. This plant is known for promoting the growth of thicker hair, restoring natural shine, strengthening roots, and reducing hair loss. It is hypoallergenic, imparting added hair texture for a denser appearance and offering protection from the sun and daily environmental factors.

The plant contains four saponin glycosides, which effectively remove excess sebum without causing side effects. These saponins also possess antibacterial and antifungal properties, making them valuable ingredients in cosmetic applications, as noted by Aghel et al. in 2007.[32]

CONCLUSION:

Globalization has become an essential requirement in today's world, and by 2005, the global market will be accessible to all. The global trend is shifting towards the utilization of herbal medicines for healthcare, health foods, and cosmetic products, including hair preparations. India, with its diverse climatic conditions, boasts a rich heritage in the cultivation and production of herbal medicines.

REFERENCES

1. Abu-Jdayil, B. and Mohameed, H.A., 2004. Rheology of Dead Sea shampoo containing the antidandruff climbazole. International journal of cosmetic science, 26(6), pp.281-289.
2. Aghel, N., Moghimipour, E. and RAEIS, D.N., 2007. Formulation of an herbal shampoo using total saponins of Acanthophyllum squarrosum.
3. Aher, A.K., Pal, S., Yadav, S., Patil, U. and Bhattacharya, S., 2009. Evaluation of antimicrobial activity of Casuarina equisetifolia frost (Casuarinaceae). Research Journal of Pharmacognosy and Phytochemistry, 1(1), pp.64-68.
4. Ankule, A., Wani, S.D., Murkute, P.M. and Pundkar, A.S., 2020. Multipurpose herbal powder shampoo. World j. pharm. life sci, 6(5), pp.166-182.
5. Azadbakht, M., Monadi, T., Esmaeili, Z., Chabra, A. and Tavakoli, N., 2018. Formulation and evaluation of licorice shampoo in comparison with commercial shampoo. Journal of pharmacy & bioallied sciences, 10(4), p.208.
6. Deshmukh, S., Kaushal, B. and Ghode, S., 2012. Design and testing of herbal shampoo and comparative studies with herbal marketed shampoo. International Journal of Pharma and Bio Sciences, 3(3).
7. Dessai, P. and Phatarpekar, S., 2016. Formulation and evaluation of herbal shampoo: Formulations and to compare formulated sham-poo with marketed shampoos. World J. Pharm. Pharm. Sci, 5, pp.1467-1477.
8. Dubey, S., Nema, N. and Nayak, S., 2004. Preparation and evaluation of herbal shampoo powder. Ancient science of life, 24(1), p.38.
9. Gokhale, S., Pawshe, A.H., Patil, S.P., Pitambare, R.M. and Pawar, P.S., Journal Homepage:-www. journalijar. com.
10. Halith, S.M., Abirami, A., Jayaprakash, S., Karthikeyini, C., Pillai, K.K. and Firthouse, P.M., 2009. Effect of Ocimum sanctum and Azadiracta indica on the formulation of

antidandruff herbal shampoo powder. Pharm Lett, 1, pp.68-76.

11. Halith, S.M., Abirami, A., Jayaprakash, S., Karthikeyini, C., Pillai, K.K. and Firthouse, P.M., 2009. Effect of Ocimum sanctum and Azadiracta indica on the formulation of antidandruff herbal shampoo powder. Pharm Lett, 1, pp.68-76.
12. Jacob, R., Sakthivel, K.M., Kannan, N. and Guruvayoorappan, C., 2015. Formulation of cost-effective herbal shampoo powder: A comparative study with market shampoos. International journal of current research, 7(2), pp.12645-12649.
13. Joshi, N., Patidar, K., Solanki, R. and Mahawar, V., 2018. Preparation and evaluation of herbal hair growth promoting shampoo formulation containing Piper betle and Psidium guajava leaves extract. Int J Green Pharm, 12(4), pp.835-9.
14. Karnavat, D.R., Bhadane, P.S., Khairnar, R.M. and Gavit, S.S., 2022. Formulation and evaluation of herbal antidandruff shampoo. Research Journal of Pharmacognosy and Phytochemistry, 14(3), pp.179-184.
15. Kumar, A. and Mali, R.R., 2010. Evaluation of prepared shampoo formulations and to compare formulated shampoo with marketed shampoos. Evaluation, 3(1), p.025.
16. Mainkar, A.R. and Jolly, C.I., 2001. Formulation of natural shampoos¶. International journal of cosmetic science, 23(1), pp.59-62.
17. Manisha, S., Swati, D., Manisha, C. and Sonia, S., 2013. Preparation and evaluation of polyherbal shampoo powder. International journal of pharmacy and biological sciences, 392, pp.151-159.
18. Noudeh, G.D., Sharififar, F., Khazaeli, P., Mohajeri, E. and Jahanbakhsh, J., 2011. Formulation of herbal conditioner shampoo by using extract of fenugreek seeds and evaluation of its physicochemical parameters. Afr J Pharm Pharmacol, 5(22), pp.2420-7.
19. Patidar, K., 2018. Polyherbal anti-dandruff shampoo: Basic concept, benefits, and challenges. Asian Journal of Pharmaceutics (AJP), 12(03).
20. Patil, S.S., Mane, Y.J. and Mohite, S.K., 2015. Formulation and evaluations of herbal shampoo powder. Int J Adv Res, 3, pp.939-46.
21. Pundkar, A.S. and SUJATA, P., 2020. Formulation and evaluation of herbal liquid shampoo. World Journal of Pharmaceutical Research, 9(5), pp.901-911.
22. Saad, A.H. and bazigha Kadhim, R., 1802. Composition and development of herbal shampoo from Ziziphus spina leaves extracted. International Research Journal in Ayurveda & Pharmacy, 2(6), p.2011.
23. Suriyprakash, T.N.K., Kalaivani, R., Lakshmana Prabu, S. and Sumathi, A., 2011. Formulation and evaluation of various cosmetic and dental product. Elixir Pharmacy, 39, pp.4639-4642.
24. Vijayalakshmi, A., Sangeetha, S. and Ranjith, N., 2018. Formulation and evaluation of herbal shampoo. Asian J Pharm Clin Res, 11(4), pp.121-4.
25. Yateem, H., Hanania, M. and Mosleh, N., 2018. Formulation and evaluation of herbal shampoo containing olive leaves extract.
26. Nasrin, A., Eskandar, M. and Azadeh Raies, D., 2008. Formulation of herbal shampoo using total saponins of Acanthophyllum squarrosum.
27. Agner, T., Serup, J., Handlos, V. and Batsberg, W., 1989. Different skin irritation abilities of different qualities of sodium lauryl sulphate. Contact Dermatitis, 21(3), pp.184-188.
28. LeBlanc, A., Dumas, P. and Lefebvre, L., 1999. Trace element content of commercial shampoos: impact on trace element levels in

hair. Science of the total environment, 229(1-2), pp.121-124.

29. de Groot, A.C., Bruynzeel, D.P., Bos, J.D., van der Meeren, H.L., van Joost, T., Jagtman, B.A. and Weyland, J.W., 1988. The allergens in cosmetics. Archives of dermatology, 124(10), pp.1525-1529.
30. Aghel, N., Moghimipour, E. and RAEIS, D.N., 2007. Formulation of a herbal shampoo using total saponins of Acanthophyllum squarrosum.
31. Tennant, R.W., Margolin, B.H., Shelby, M.D., Zeiger, E., Haseman, J.K., Spalding, J., Caspary, W., Resnick, M., Stasiewicz, S., Anderson, B. and Minor, R., 1987. Prediction of chemical carcinogenicity in rodents from in vitro genetic toxicity assays. Science, 236(4804), pp.933-941.
32. Cowley, N.C. and Farr, P.M., 1992. A dose-response study of irritant reactions to sodium lauryl sulphate in patients with seborrhoeic dermatitis and atopic eczema. Acta dermato-venereologica, 72(6), pp.432-435.

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