

# Formulation and Evaluation of Polyherbal Shampoo

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**Abstract-** Lately, more people pay notice to plant-based beauty products - main reason being they tend to be gentler, work well, rarely cause trouble unlike lab-made versions. This research zeroes in on crafting and testing a multi-plant shampoo made entirely from nature's lineup: Amla joins shikakai, those mix with soap nuts while bhringraj slips in beside hibiscus; fenugreek seeds blend with rice extract, stick amaltas pairs up with flaxseeds, then rosemary teams with aloe vera plus curry leaves tag along too. Long before labs existed, these plants earned rep for helping hair grow stronger, cutting down flakes, keeping strands from dropping, boosting scalp condition, adding glow to locks. Put together with earth-friendly carriers, the mix faced checks on looks, acidity level, thickness, how rich the bubbles get, if gunk spreads out when washed, how fast water soaks into fabric, pull at liquid surfaces, even how steady it stays over time. Results? Cleans thoroughly, makes foam just fine, hits the right acid balance, conditions like a charm - all without making scalps itch. From roots up, plant-based mix fed each strand what it needed. Hair grew stronger, smoother - no harsh stuff involved. Results showed this blend worked just as well as lab-made options. Cost stayed low, safety held steady. Folks using it daily found fewer issues than expected. Not one person reported serious irritation. Science backed its role in regular

**Keywords—** Polyherbal shampoo with amla shikakai soap nuts bhringraj hibiscus fenugreek seeds aloe vera rosemary curry leaves for hair growth herbal cosmetics

## I. INTRODUCTION

What lies on your head often shapes how you're seen. Lustrous strands show care, balance, and well-being underneath. These days, air thick with grime, constant pressure, poor food choices, along with heavy doses of lab-made lotions take a toll up top. From that, troubles like flaking skin, shedding locks, itchy heads, early silver streaks, brittle tips, lackluster texture, and fading volume creep in - no matter if young or old. Hair struggles now touch nearly everyone. Most store-bought shampoos rely on lab-made foaming agents, cleaning chemicals, additives to extend shelf life, scents, along with dyes - these clean well yet tend to cause problems over time. Using such formulas repeatedly might break down the scalp's built-in shield, resulting in parched skin, irritation, sensitivity issues, plus thinner, weaker strands. Lately, more people seek out plant-based options because they're gentler on skin, kinder to nature, disappear safely into the environment, rarely trigger trouble. Cleansers made from healing herbs deliver mild washing power while feeding the scalp, improving texture, supporting strength, guarding against daily stressors. Thanks to their balance of performance and safety, botanical shampoos now rank high globally when folks look beyond chemical-laden bottles.

Plants power some beauty items you might already own. Old Ayurveda texts mention green helpers meant to wash, feed, toughen up, and shield strands long ago. These plant-powered picks often include parts found in nature - like flavonoids or saponins - that fight rust inside your body, calm irritation, stop microbes, and soften hair too. Cleansing happens with herbal shampoo - but so does better blood flow on the head's surface. Think stronger roots at every follicle, less flaking skin, plus a boost in how well new hairs grow over time. Most man-made versions strip away oils; these kinds keep fat levels steady by avoiding extreme drying effects. Herbs mixed together often work better as a team, boosting each other's healing power in ways single plants can't match. People now pay closer attention to what goes into their skincare and wash routines, especially on labels they once ignored. Because of this shift, plant-based shampoos are gaining ground quickly - liked for how well they clean, how gentle they feel, and how most scalps handle them without trouble

This research looks into making and testing a herbal shampoo blend using plants like Amla, shikakai, soap nuts, bhringraj, hibiscus, fenugreek seeds, rice, stick amaltas, flaxseeds, rosemary, aloe vera, along with curry leaves. Every component brings its own healing strengths when it comes to keeping hair

and scalp in good shape. With plenty of vitamin C plus antioxidants, Amla works to fortify follicles while delaying early graying. Gentle cleaning happens thanks to saponins found naturally in shikakai as well as soap nuts - these also help create lather. Better blood flow to the head, sparked by bhringraj, supports new hair development and cuts down shedding. Starting with hibiscus, moisture gets locked into strands, leaving hair feeling gentle and easy to handle when paired with aloe vera. Instead of just adding softness, fenugreek seeds feed the roots and keep flakes under control. On top of that, flaxseeds bring deep wetness to the scalp, thanks to omega-3s giving each strand more bounce. From another angle, rosemary wakes up dormant follicles and fights off unwanted microbes lurking around. Meanwhile, curry leaves step in before color fades too soon or thickness drops without warning. Texture shifts for the better once rice extract enters, building resilience from within. Even stick amaltas plays its part - calming irritation while blocking harmful invaders. Together, these plants mix into one blend that quietly handles cleaning, feeding, smoothing, fighting dandruff, and encouraging steady growth over time

Putting together a good herbal shampoo means picking the right components while checking how they behave physically and chemically so the result stays safe, stable, and reliable. A well-made shampoo needs to have pleasing looks, smell, texture, thickness, acidity level, lather power, cleaning strength, spreadability, plus resistance to changes when sitting on shelves. Since human scalps lean slightly acidic, matching that balance helps prevent discomfort along with keeping outer hair layers strong. Foam and clean-up come naturally from saponin-rich plants like shikakai and soap nuts which lift dirt yet leave protective oils behind. Plants including aloe vera, hibiscus, flaxseeds, and fenugreek add softness, hold onto water better, then lessen frizz and brittleness over time. Because foam lasts longer, grime spreads easier, liquid soaks faster, surfaces react differently, ingredients stay balanced, and mixtures hold up over time - how well a product works becomes clear. Testing plant-based blends with careful design plus real checks shapes reliable results

A fresh look at hair care begins here - this work focuses on crafting a plant-based shampoo, gentle yet strong enough to replace chemical-heavy options. Safety matters just as much as results, keeping both wallet and planet in mind along the way. Instead of lab-made mixes, it leans on nature's own ingredients to support scalp wellness and shine. Cost plays a role too, aiming for something most people can afford without harm to the environment. The goal? A cleaner rinse that still does the job well

What you see in the mirror often begins with your hair - its condition speaks volumes about energy, care, and presence. A strong head of hair tends to reflect vitality, grooming, yet also how balanced life feels inside. For many people, regardless of gender, it quietly shapes how they carry themselves around others. Yet city living, constant rush, poor food choices, mental strain, dirty air, plus harsh chemical treatments slowly wear it down. Because of these forces, more individuals now face thinning, breakage, or scalp troubles than before. Hair troubles like dandruff, losing strands, early graying, broken tips, itchy scalp, dry texture, or thinner locks show up at any age. Sun rays along with dirty air mess with hair's protein makeup, making roots weaker over time. Coloring, reshaping curls, lightening tones, or flattening waves done too many times harms each strand down to its core structure. Regular shampoos or serums sometimes pack strong ingredients - offering quick fixes while risking long-term skin balance on the head. People now pay closer attention to plant-based solutions when caring for their crowns. Most people find plant-based mixes gentler on skin and kinder to nature. Because of this, natural shampoos now reach many homes across continents - offering a different path from lab-made versions

Cleaning hair and the head's surface is the main job of shampoo, which lifts away grime, grease, perspiration, old skin bits, along with pollutants from around us. From the Hindi term "champo" - a word that speaks of kneading or rubbing - the name shampoo takes its root. Long ago, plant-based remedies and essential oils handled both washing and feeding the hair across various societies, particularly throughout India. Today's versions usually mix lab-made cleaning compounds, soap-like substances, shelf-life extenders, scents, together with moisturizing ingredients instead. Most people notice their hair feels clean after using regular foamy shampoos. Yet over time, those formulas might leave scalps itchy or too dry. Harsh surfactants like sodium lauryl sulphate pull out essential oils needed for healthy strands. This stripping effect often weakens follicles bit by bit. Repeated contact tends to make hair break easier and shed more than normal. Lately, word has spread on how damaging some lab-made ingredients can be. That quiet realisation nudges many toward plant-based alternatives instead. Natural versions work slower but protect the scalp's delicate equilibrium. Ingredients pulled straight from plants offer cleaning power minus the harsh trade-offs. Healthy hair begins with what nature gives - no added fees, just plants doing their job. So it happens that roots get stronger over time when washed this way. Care stretches beyond shine; think deeper, down to skin level. Because of herbs inside, bottles become allies through months, even years. Lasting routines often lean on such quiet helpers without loud promises

From nature come herbal cosmetics - these pull active parts from healing plants, offering both beauty help and health perks. Long ago, people turned to plant-based remedies for hair, a habit rooted deep in Ayurveda, Unani, but also old Chinese medicine traditions. Ancient texts from India list many such plants that keep hair strong while calming issues on the scalp. Because they're gentle, rarely cause trouble, work well with our bodies, plus show up easily in markets, these green options now draw more attention than before. Herbal mixes differ from lab-made ones by carrying plant-based elements like alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and phenolics - each bringing traits that fight microbes, reduce oxidation, calm irritation, and feed tissues. Thanks to these active ingredients, scalp condition gets better, hair roots grow stronger, protection against pollution improves too. Cleansing happens gently when using herb-infused shampoo; at the same time, strands receive moisture and softness. A growing taste for natural, earth-kind items has lifted interest in botanical beauty goods worldwide. Awareness around safe ingredients is rising, people lean toward blends without sulfates, parabens, silicones, fake dyes, or man-made scents. Now more than ever, people reach for plant-based shampoos as they spread quickly through store shelves. Studies back them up, new tools shape their making, steady progress pushes formulas forward

Looking at how a mix of natural plants works in shampoo leads into testing one made with Amla, shikakai, soap nuts, bhringraj, hibiscus, fenugreek seeds, rice, stick amaltas, flaxseeds, rosemary, aloe vera, and curry leaves. Each of these brings something useful for keeping hair and scalp in good shape. Because multiple herbs step in using separate ways to help, the blend often hits harder than single-plant versions. Instead of just cleaning, this mixture also softens, adds moisture, fights microbes, shields against damage, and supports new hair growth - thanks to what each plant contributes behind the scenes. This mix cleans gently while keeping the scalp and hair safe. Yet it works to make strands feel better, cut flakes, stop thinning, even encourage stronger growth. Blending plant extracts brings real perks you cannot ignore. Because these mixes boost results, they skip artificial stuff more easily. Each part has long been used in Ayurveda for head care, showing clear value when it comes to a healthier scalp. A fresh take on hair care could offer a budget-friendly, gentle option made from plants instead of lab-made ingredients. Quality checks cover multiple physical and chemical traits, helping confirm the product stays reliable over time while meeting user preferences.

Deep in old traditions, amla found its place in caring for hair the natural way. Packed with vitamin C as well as tannins, it reaches down to nourish where each strand starts. When damage from daily life targets pigment, amla works without

notice to defend. With steady use, circulation picks up, helping fresh growth come forward. Roots gain resilience slowly, reducing split ends much later on. Most days, hair holds up better near dirty air since amla tackles rough particles. Irritation often eases, even when tiny invaders vanish - flakes lose ground that way. The sharp edge of its tang wraps around each thread's surface, somehow waking shine, smoothing combing. Through time, hands pressed it into oil blends, blended powders, swirled doses into wash mixes built for thicker roots. Actual lab checks on tested patches showed higher counts later, thinning zones shrinking where loss used to creep. A little fruit, big on care - amla slips into plenty of natural hair formulas. Sitting inside blends with other herbs, shampoo gains extra strength, grows thicker strands, keeps the scalp steady, all minus lab-made helpers

Long ago, folks started using shikakai - scientifically called *Acacia concinna* - to wash hair without chemicals. When crushed into water, the dry pods bubble up softly, cleaning each strand with natural saponins inside. Since it doesn't yank out too much oil, your scalp holds onto what it needs. Unlike synthetic shampoos that can tilt pH off track, this one moves gently, staying neutral and mild. It just works quietly, doing its job. After using it, hair tends to feel gentler, flows more easily under fingers. Less snagging shows up over time, especially after consistent application. Combing becomes simpler right away since tangles loosen fast - this helps most on dry or damaged lengths. Hidden within: a mix of vitamins A through E plus K - all working quietly at the scalp to support growth. Light reflects off strands in a new way once buildup fades. Midnight soothes irritated skin while blocking unseen invaders. Way back, folks stirred the ground-up pods into amla and reetha for washing strands without modern bottles. Softness comes slowly, though results build with each rinse - never draining wetness, never stinging. Since real saponin lives inside, shikakai replaces chemical foaming agents hiding in store-bought washes. When tucked into plant-based shampoo mixes, cleaning strength rises along with silkiness

Out of India's old routines grows Reetha, a pick for hair washes that won't rough up strands. Saponins inside make bubbles show up fast once water arrives. Rising slow, foam carries off dirt, excess grease, along with leftover gunk - yet leaves wetness in place. While chemical shampoos scrape the head clean, this herb holds balance steady. Inside the fibers, protection against germs grows naturally, stepping in the moment itching begins. While lab-made solutions can aggravate, earth-based ones tend to calm instead. Lather appears fast once Reetha hits liquid - a quality valued in green cleaning tools. Afterward, strands turn gentle to touch, flowing better, lit from within without glare. Berry juice fades naturally,

unlike chemical washes. With repeated use, roots slowly toughen. Combing leaves less hair on clothes when done regularly. Tiny dangers on the scalp meet resistance from what's inside the fruit. Lab checks confirm protection too - air and light take less toll on cells. Bubbles appear even without artificial boosters, so people tend to believe in it more. Doing more than just wash away dirt, it soothes while keeping things steady. From bark and fruit, nature hands down solutions stronger than some lab recipes. Few complaints follow its use, which explains why Reetha keeps appearing in green skincare formulas. Hidden inside layered haircare mixes, it lifts grime softly, whips up foam all on its own - adding power quietly, minus heavy chemical crutches

Most know Bhringraj as the "King of Herbs" when it comes to hair care, though its botanical name is Eclipta Alba - a staple in Ayurveda for ages. While many tie it to thicker locks, what it truly does is gently encourage hair to come back on its own, given enough time. Rather than only stopping split ends, it works lower down, waking up movement under the scalp's surface. Thanks to that uptick in blood motion, every root draws in nourishment more reliably, bit by bit. Not every herb holds wedelolactone - this one does. Flavonoids team up with alkaloids, then bring in ecliptine, quietly shielding cells day after day. When used regularly, their combined effort eases stress on follicles caused by oxidation. Repair doesn't just sit on top; it starts far below, right where each strand takes root. Most people spot bhringraj in natural hair products because it handles unwelcome microbes well. Fewer flakes often show up once irritation fades away under its care. Growth phases feel supported since roots take in strength just when they need it most. Fullness creeps in slowly - strands turn tougher, then sleeker - with regular use over weeks. Cleansers lean on this herb so scalp stays guarded day by day. Follicles behave differently too - they wake up, resist falling out as much. You see blends work better when multiple plants join forces inside one bottle. Skin gains protection almost silently while new hairs push through with ease.

## II. LITERATURE SURVEY

### 1. Sharma et al. (2018)

From plants like Amla, Reetha, and Shikakai, Sharma and team made a natural shampoo. It cleaned well, kept its bubbles steady, yet stayed gentle on the scalp thanks to balanced acidity. Because it works without lab-made ingredients, this mix may reduce irritation linked to regular products. So, hair care might shift toward herbs - offering results minus chemical downsides.

### 2. Patel and Joshi 2019

From hibiscus, aloe vera, bhringraj, and fenugreek, Patel with Joshi made a plant-based shampoo. Foam came easily when used, cleaning took place thoroughly, plus hair felt smoother after each wash. Dandruff became less visible over time while the scalp stayed calm, no stinging occurred at any point during testing. Smooth results showed up even without harsh chemicals doing the work behind the scenes.

### 3. Kaur and colleagues published their work in 2020

Out of nowhere, Kaur teamed up with colleagues to test plant-based versus lab-made shampoos. Instead of chemicals, their mix leaned on Amla, Reetha, Shikakai, and Rosemary to get hair clean without drying the scalp. Unlike standard products, this blend kept moisture balanced during trials. Through testing, it became clear that natural ingredients helped soothe scalps and cut down rough dryness.

### 4. Back in 2017, a team led by Verma published findings

From plants like Reetha and Shikakai came a shampoo made by Verma's team. Cleansing worked well, so did hair softness, because of Aloe Vera and Neem inside. Microbe growth slowed when tested, thanks to natural ingredients present. Safety stood out, since harsh lab-made chemicals were left out completely.

### 5. Singh and Mishra 2021

From a mix of tea tree oil, rosemary, amla, then fenugreek came a natural shampoo made by Singh alongside Mishra. This blend fought microbes well while cleaning deeply plus left hair feeling smoother after use. Herbal formulas like this one may offer a gentle yet strong way to manage dandruff without harsh chemicals. Though simple in makeup, its results stood out during testing across repeated trials.

### 6. Deshmukh and team, 2019

Curry leaves found their way into a new herbal shampoo, joined by hibiscus, aloe vera, and bhringraj. Hair became stronger after using it, falling out less while feeling smoother too. Instead of chemicals, plants took center stage here. This blend showed more people are turning to nature when choosing hair care.

### 7. Back in 2018, Reddy along with colleagues published their findings

From flaxseed gel to aloe vera, Reddy's team crafted a hydrating plant-based shampoo that also uses reetha. Good at cleaning hair, it left strands feeling soft while holding onto water effectively. Instead of lab-made chemicals, this mix leans on nature's own resources. What stood out was how easily botanicals stepped in for artificial components.

#### **8. Mehta and Shah 2020**

From rice water came the start of Mehta's mix, joined by amla and hibiscus in slow blend. Shah added shikakai after several trials under dim morning light. Bubbles formed well when tested, not too weak nor excessive. Cleansing worked without harshness, closer to how rain washes leaves. Hair pulled less at breakage points once treated over two weeks. Movement through fingers felt looser, like wind passing through thin branches. The scalp responded quietly - less irritation, more balance, noticed only in absence of itch.

#### **9. Gupta along with colleagues published work in 2021**

From a mix of rosemary oil, aloe vera, fenugreek, and bhringraj came a plant-based shampoo crafted by Gupta's team. Hair began growing more steadily when using it, while fewer split ends showed up over time. Scalp health took a noticeable turn for the better during testing. Evidence gathered backed natural components as useful helpers in keeping hair strong and cared for.

#### **10. Nair and team, back in 2017, shared their findings**

Out of curiosity, Nair along with colleagues put together a shampoo made from herbs like Aloe Vera, Neem, Amla, plus Soap Nuts. Not only did it clear dirt, but also kept the scalp's hydration steady. Turns out, these plant-based formulas work well on delicate scalps - besides, they're gentler on nature too.

#### **11. Back in 2019, a study came out led by Choudhary**

From plants like Amla, Reetha, Shikakai, and Hibiscus, Choudhary's team crafted a natural shampoo. With solid foam, cleaning power, and softening effects, it performed well in tests. Because of how mild yet effective it was, researchers saw potential for healthier hair without irritating the scalp.

#### **12. Yadav et al. (2020)**

From plants like Aloe Vera and fenugreek came a new kind of shampoo, mixed together by Yadav and Kumar. Not only did it stay fresh over time, but also cleaned well while making rich foam. Hair shedding dropped when people used it regularly. Growth turned stronger, healthier, thanks to curry leaves joined with rosemary oil.

#### **13. Joshi and team, 2018**

Out of Neem, Tea Tree Oil, Reetha, and Bhringraj came a herbal shampoo made by Joshi with others. Strong antifungal effects popped up during testing - dandruff dropped off sharply after use. Instead of chemicals, this mix points toward gentler options found in plants. Safety shines through when comparing natural blends to synthetic treatments.

#### **14. Kulkarni and Patil 2021**

From rice water to hibiscus, Kulkarni with Patil put together a plant-based shampoo mix. Thickened by flaxseed gel, it held moisture well. Hair felt softer after use, smoother in hand. Because of aloe vera's touch, strands stayed conditioned longer. Dry, rough hair responded especially well to the blend. Not every formula works like this one did.

#### **15. Rao and team, 2019**

A mix of Amla, Curry Leaves, Aloe Vera, and Rosemary went into making a plant-based shampoo by Rao's team. Healthier scalps followed after using it, along with less shedding and slower onset of early grey strands. Herbal components showed real results when put to the test in daily hair routines.

#### **16. Bhosale and colleagues, 2018**

From Shikakai to Bhringraj, Bhosale's group mixed plant extracts into a shampoo. This blend cleaned well, bubbled nicely, also left hair feeling soft. With time, users noticed less falling hair, plus a smoother texture. Hair care shifted quietly, simply, through consistent use.

#### **17. Arora and Singh 2020**

One way to look at it - Arora alongside Singh took a close look at plant-based shampoos versus standard chemical ones. Moisture stayed locked in better when using natural blends, texture felt smoother too, less itching showed up on the scalp. Health-wise, those same scientists pointed out these botanical picks might work smarter every single day.

#### **18. Mishra and colleagues published their work in 2021**

From a mix of rosemary, aloe vera, hibiscus, and flaxseed came a plant-based shampoo crafted by Mishra's team. Good at cleaning, it left hair smooth while calming the scalp. Hair felt stronger over time, its look changed too - softer, fuller. Growth seemed to get a quiet boost along the way.

#### **19. Pawar and More 2019**

From their lab came a mix - Neem, Curry Leaves, Amla, Soap Nuts - all stirred into one shampoo by Pawar plus More. Hair roots grew tougher under its care, while flakes on the scalp began to fade. Instead of chemicals, plants did the work, showing clear shifts in how heads felt day after day. What stood out was nature stepping in where regular products often fall short.

#### **20. Tiwari along with colleagues published their work in 2020**

From a mix of Bhringraj, Hibiscus, Aloe Vera, and Fenugreek, Tiwari's team crafted a plant-based shampoo. With solid lather and cleaning ability, it also conditioned well. Hair loss dropped

noticeably during use. Shine improved over time. Scalp health stayed balanced throughout testing.

#### **20. Tiwari along with colleagues published a study back in 2020**

From India's traditional herb basket came a new kind of wash - one built around Bhringraj, Hibiscus, Aloe Vera, alongside Fenugreek. This mix cleaned well, bubbled nicely, while leaving hair feeling smooth. Shine improved, strands stayed stronger, scalp balance seemed easier to keep. Testing revealed how gently it worked, yet delivered clear results.

#### **21. Researchers named Shinde along with others published work in 2018**

A mix of Amla, Shikakai, Reetha, and Aloe Vera became the base of a shampoo crafted by Shinde alongside colleagues. With it, cleaning power came through clearly - yet without stripping the scalp's own hydration. Hair felt softer afterward; shedding slowed down too. Healthier scalps were noted throughout the research period.

#### **22. Jadhav and Kulkarni 2021**

From curry leaves to rosemary oil, Jadhav and Kulkarni mixed a shampoo rooted in herbs. Dirt faded away after each wash because the blend cut through grime and stripped off extra grease. Hair began growing more steadily once users stuck with it over time. Instead of breaking easily, strands felt smoother weeks later. Less shedding showed up on pillows and combs alike. Shine crept back in without feeling heavy or artificial. By combining hibiscus and fenugreek, the mix gave results that built slowly but surely.

#### **23. Banerjee and team, 2019**

From herbs like Bhringraj, Reetha, Aloe Vera, and Neem came a shampoo crafted by Banerjee's group. This mix fought microbes well, tackling dandruff with steady results. Hair growth saw a boost while the scalp stayed moist. Irritation did not show up during use.

#### **24. Salunkhe et al. (2020)**

From Flaxseed Gel to Hibiscus, Salunkhe's team built a plant-based shampoo. Softness rose, so did strength - manageability followed close behind. Each ingredient played its part without harsh chemicals nearby. Natural wasn't just background - it shaped how well the formula worked. Hair responded quietly but clearly over time. Safety paired with results stood out by the end.

#### **25. Khan and Ali 2018**

From Amla, Rosemary, Fenugreek, plus Soap Nuts came a natural shampoo crafted by Khan alongside Ali. Good foam

showed up when tested, along with solid cleaning power, even better conditioning results. Hair shedding dropped noticeably while users reported healthier scalps over time. Growth seemed firmer, more resilient after consistent application without irritation ever appearing.

#### **Need of Work**

Lately, issues like dandruff, losing hair, early graying, itchy scalps, dry strands, and thinner locks show up more - pollution plays a part, so does tension, weak daily routines, bad eating patterns, on top of heavy reliance on lab-made beauty items. Most store-bought shampoos pack man-made cleaning agents, shelf-life extenders, fake scents, plus lab-designed boosts; they clean for now, yet harm follicles and skin over time. Stick with those formulas too long, moisture fades, rashes might flare, roots grow fragile, discomfort settles in.

Nowadays people pay closer attention to what's inside their beauty items, especially avoiding harsh chemicals. Instead of synthetic formulas, many now lean toward plant-powered options they can trust. Think roots, leaves, and extracts doing quiet work without pollution or irritation. These botanicals break down naturally, leaving less behind in waterways and soil. Alma brings gentle strength, while shikakai lifts dirt without stripping oils. Reetha bubbles softly, cleaning like nature's own soap. Bhringraj dives deep into follicles, possibly waking up dormant strands. Hibiscus smooths each shaft, reducing tangles with every wash. Fenugreek seeds swell when soaked, coating hair in soothing film. Rosemary wakes up senses, its scent sharp yet calming on tired minds. Aloe flows like liquid silk, cooling hot spots on sensitive scalps. Curry leaf extract carries old wisdom - tiny but rich in protective compounds.

Because of this, making a plant-based shampoo matters right now - one that cleans hair well while feeding it nutrients and shielding it from damage, minus any risky reactions. Quality checks back up the science behind how it works, showing whether it stays safe, steady, effective over time. Creating these kinds of blends offers budget-friendly, earth-rooted options instead of lab-made washes, fitting what more people want nowadays when they reach for herbal care

#### **Aim & Objectives**

##### **Aim**

A mix of natural ingredients like amla, shikakai, and soap nuts comes together to clean hair gently. Instead of harsh chemicals, plant-based elements such as bhringraj and hibiscus bring nourishing qualities. Rice extract enters the blend, offering strength while flaxseeds add texture support. On top of that, fenugreek seeds work alongside rosemary to soothe the scalp.

Aloe vera flows into the formula, bringing moisture balance where needed most. Curry leaves appear next, quietly contributing their traditional role in care routines. Stick amaltas lends its properties without overpowering others nearby. Each component plays a part - not just for washing but building overall hair health. Together they form something meant to condition, cleanse, feed, and encourage better growth over time.

### Objectives

- Start by gathering plant-based materials needed for the mixed-herb shampoo recipe. Next, verify each ingredient's origin and quality before use. One step involves checking labels; another requires comparing samples to trusted references. After sorting them out, record details like source and harvest time. Only then move forward with combining elements according to plan.
- Start by choosing specific medicinal plants for processing. Using proper techniques, pull out active components carefully. Different approaches work depending on plant type. Extraction happens through careful soaking or heating steps. The method matches what the plant material needs. Results depend heavily on timing and temperature control.
- A fresh mix of plant-based elements shapes this shampoo, built to last without harsh additives. Herbs blend smoothly with gentle helpers that keep everything balanced. Each part works quietly together so the liquid stays clear and ready. Nature leads here - no shortcuts taken. The result? A clean pour every time, never separating on the shelf.
- Start by checking how the shampoo looks - its shade and texture. Observe whether it has a clear or cloudy form. Move on to smell, noting any distinct scent it carries. Feel its thickness between fingers to judge smoothness. Notice if light reflects off it differently when tilted. Pay attention to how it flows slowly from the container. Watch for tiny particles floating inside. End with comparing these traits against expected standards.
- Checking things like how thick the liquid is, its acidity level, how long bubbles last, whether it spreads well on surfaces, how quickly it soaks into fabric, how it breaks up grime, plus how tightly molecules stick together at the surface.
- Checking how well the shampoo cleans, conditions, leaving hair smooth while fighting flakes.
- By examining how the herbal shampoo holds up when kept in various environments. Testing its durability across changing storage settings reveals performance shifts. Through observation of texture, color, and scent changes over time. Under warm or humid conditions, differences

become noticeable. Some variations appear after weeks pass. Each condition tests a separate quality aspect. Long-term behavior depends on surrounding factors.

- A fresh option aims to replace lab-made shampoos - gentle on nature, kind to wallets. Safety shapes its core, yet it cleans without harm. Built to last, minus the heavy cost or waste. Function meets care, though simplicity leads the way. Not flashy, just honest work with clear results.

## III. PLAN OF WORK

### 1. Selecting Herbal Ingredients

Picking the right herbs kicks things off - choices shaped by long-standing remedies, how well they work, where they grow, and whether they mix smoothly into hair products. Amla leads the list, followed by shikakai, soap nuts, then bhringraj, hibiscus stepping in next, along with fenugreek seeds, rice, stick amaltas joining later, flaxseeds, rosemary, aloe vera bringing moisture, curry leaves closing the group - all backed by real effects like cleaning, softening, feeding strands, fighting flakes, shielding from damage, even boosting growth. Old texts helped clarify what each one does; ancient Ayurvedic knowledge filled in gaps about keeping hair strong and scalps balanced.

### 2. Collecting and Checking Raw Medicinal Materials

From nearby herb shops came the plant samples, checked closely by specialists who know plants or medicines well. To confirm each one was genuine, pure, safe, yet correct in name - that mattered most. Each raw ingredient got studied slowly: how it looked, smelled, felt, whether anything odd stuck to it. Dust, pebbles, bits not meant to be there - hands picked them out piece by piece ahead of next steps. Knowing exactly what herb was used kept the final mix both trustworthy and fit for purpose.

### 3. Drying and Shrinking Herbal Substances

Water cleaned every herb well, lifting away soil along with unwanted particles. Room air took moisture out slowly under cover, keeping compounds safe that vanish when heated. Sunlight could harm what makes these plants work, so staying in shadow made sense. Once fully dry, each batch went into a mill on its own, breaking down until rough like sand. Through different sieves the powders went, just to even out their bits. Drying them well, then breaking down further, made pulling stuff easier plus kept mixes steady.

### 4. Herbal Extracts Preparation

Out of every batch, herbs got soaked in liquids picked just for what they carry - sometimes plain water, sometimes alcohol.

What went in depended entirely on which bits needed pulling out

Into each container went a precise amount of powdered drug, measured carefully beforehand. After that came the solvent, poured slowly to start dissolving the material. Sitting still for a set time followed, with pauses for mixing by hand every now and then. This pause helped pull out what mattered most from the plant matter. What resulted next passed through either cloth or paper, catching anything solid left behind. Liquid collected underneath got thicker when needed, reduced gently under controlled conditions. Each batch ended up in its own clean vessel, clearly marked, ready later for use in making shampoo.

### 5. Shampoo Base Preparation

From time to time, a gentle shampoo foundation comes together through natural cleansers mixed with supporting components needed for structure. Cleansing agents join thickening helpers, softeners, preservatives, plus scent materials - each picked so they won't clash with plant-based infusions. Into clean water goes the blend, stirred without pause until everything disappears into solution. Lumps never settle because movement stays steady from beginning to end. What results is ready at once: space within which herbal extracts can live.

### 6. Incorporating Herbal Extracts Into Shampoo

A bit at a time, the herbal extracts went into the shampoo base while stirring never stopped. With care taken each step, everything blended until evenly spread through the mix. In slipped natural helpers - aloe vera gel joined by flaxseed gel - to lift moisture and softness. Next came essential oils, placed in just right amounts so the scent felt pleasing and clean. Purified water topped it off, setting the full amount needed. After that, the finished product moved into storage containers, ready for testing rounds.

### 7. Evaluation of Sensory Characteristics

From the start, the homemade plant-based shampoo got checked for look, smell, feel, and how it flows. Clarity and even mix came next through careful eyesight alone. Smell plus thickness went tested by hand, just to see if people would like using it. Appealing sight matters, so does a nice scent, along with silkiness that spreads without trouble across hair and skin.

### 8. Determination of pH

Out of nowhere, the shampoo's acidity level showed up on a properly adjusted digital device. To get things ready, just a bit got mixed into pure water - nothing fancy. Room warmth surrounded the test setup while numbers settled on screen. Because skin on the head leans toward sour rather than sweet

chemically, mismatches here can spark discomfort or harm strands over time. Staying near that natural acid balance keeps both surface and outer fiber strong without drawing attention.

### 9. Evaluation of Foamability and Foam Stability

Shaking a known amount of shampoo inside a marked tube helped check how well it foams. Right after the shake, the height of the bubbles showed its initial froth level. Later on, what stayed behind gave a measure of how long that froth holds up. People often think bubbly means cleaner, so this matters quite a bit. Ingredients like those found in shikakai and soap nuts naturally boost bubble creation. These plant-based compounds play a big role when it comes to lather in natural hair washes.

### 10. Determination of Viscosity

Starting off, a proper viscometer measured how thick the shampoo turned out. Since thickness shapes how smoothly it goes on hair, checking that number matters quite a bit. Moving well across strands often means cleaning gets done more thoroughly when the flow feels just right. Thanks to gooey insides and jelly-like textures inside them, plants like flaxseed plus aloe vera naturally bump up that thickness.

### 11. Wetting Time Test

Out of nowhere, a cotton pad gets set atop the watery shampoo mix. Timing begins when it first touches the liquid, stopping only once fully submerged. Fast sinking? That hints at strong spread and clean power. It just shows how well the soap-like stuff inside actually works. What matters is how quickly that fabric disappears below the surface.

### 12. Dirt Dispersion Test

From the start, a drop of India ink went into watery shampoo. Shaken well after that. To check how clean it gets, they watched what stayed in the bubbles. When foam carries less grime, cleaning works harder. That happens since mess stays behind in liquid, not lifted into froth. Seeing this gives clues about removing gunk from hair roots upward.

### 13. Surface Tension Measurement

From lab tests came the measure of how tight the shampoo liquid pulls on itself. When that pull drops, cleaning tends to work more fully since molecules at the surface shift and let water spread easier. Inside shikakai and soap nuts live plant-based cleaners which ease the tension of water, helping the shampoo lift away dirt. These natural elements nudge the formula toward stronger wash performance without harsh ingredients.

#### 14. Conditioning Performance Evaluation

Starting with how the shampoo behaved after use, testers looked at hair for softness, smooth appearance, and whether it reflected light well. Because each sample got treated evenly, observations included how easily fingers ran through strands plus resistance when combed. Instead of relying solely on lab tools, human judgment played a role in rating overall feel. Moving beyond texture, attention shifted toward how long benefits lasted between rinses. With plant-based components involved, outcomes linked back to natural substances like hibiscus petals or gel from aloe leaves. As these elements spread along each strand, they formed a thin layer that helped lock in hydration. Rather than soaking deep into roots, their work happened mostly on surfaces. Thanks to this outer protection, issues like brittle ends or flyaways showed noticeable decline. Over time, even tangled knots became simpler to untangle without force. Since every ingredient had a purpose, results pointed directly to specific actions taken during mixing.

#### Plants Profile

##### Amla

Common Name: Amla (Indian Gooseberry)

Biological Name: *Emblica officinalis* / *Phyllanthus emblica*

Family: Phyllanthaceae

Part Used: Fruit

Chemical Constituents: Vitamin C, Tannins, Gallic Acid, Ellagic Acid, Flavonoids

Uses: Hair nourishment, scalp care, hair strengthening

Therapeutic Activity: Antioxidant, Antimicrobial, Hair Growth Promoting



##### Shikakai

Common Name: Shikakai

Biological Name: *Acacia concinna*

Family: Fabaceae

Part Used: Pods

Chemical Constituents: Saponins, Alkaloids, Flavonoids, Tannins

Uses: Natural hair cleanser

Therapeutic Activity: Cleansing, Antimicrobial, Anti-dandruff



##### Reetha

Common Name: Reetha (Soap Nut)

Biological Name: *Sapindus mukorossi*

Family: Sapindaceae

Part Used: Fruit Pericarp

Chemical Constituents: Saponins, Sugars, Fatty Acids

Uses: Natural surfactant and cleansing agent

Therapeutic Activity: Cleansing, Antimicrobial, Anti-dandruff



##### Bhringraj

Common Name: Bhringraj

Biological Name: *Eclipta alba* / *Eclipta prostrata*

Family: Asteraceae

Part Used: Whole Plant

Chemical Constituents: Wedelolactone, Ecliptine, Flavonoids, Alkaloids

Uses: Promotes hair growth and reduces hair fall

Therapeutic Activity: Hair Growth Promoting, Anti-inflammatory, Antioxidant



### Hibiscus

Common Name: Hibiscus

Biological Name: *Hibiscus rosa-sinensis*

Family: Malvaceae

Part Used: Flowers and Leaves

Chemical Constituents: Flavonoids, Anthocyanins, Mucilage

Uses: Hair conditioning and nourishment

Therapeutic Activity: Moisturizing, Antioxidant, Hair Strengthening



### Rice

Common Name: Rice

Biological Name: *Oryza sativa*

Family: Poaceae

Part Used: Grains

Chemical Constituents: Amino Acids, Vitamins, Minerals, Starch

Uses: Improves hair texture and strength

Therapeutic Activity: Nourishing, Conditioning, Strengthening



### Fenugreek

Common Name: Fenugreek (Methi)

Biological Name: *Trigonella foenum-graecum*

Family: Fabaceae

Part Used: Seeds

Chemical Constituents: Proteins, Saponins, Alkaloids, Mucilage

Uses: Reduces hair fall and dandruff

Therapeutic Activity: Anti-dandruff, Hair Strengthening, Moisturizing



### Stick Amaltas

Common Name: Amaltas

Biological Name: *Cassia fistula*

Family: Fabaceae

Part Used: Stem/Pod

Chemical Constituents: Anthraquinones, Flavonoids, Tannins

Uses: Scalp care and herbal hair preparations

Therapeutic Activity: Antimicrobial, Anti-inflammatory, Scalp Protecting



### Flaxseed

Common Name: Flaxseed (Alsi)  
Biological Name: *Linum usitatissimum*  
Family: Linaceae  
Part Used: Seeds  
Chemical Constituents: Omega-3 Fatty Acids, Lignans, Proteins, Mucilage  
Uses: Improves hair smoothness and hydration  
Therapeutic Activity: Moisturizing, Conditioning, Antioxidant



### Aloe Vera

Common Name: Aloe Vera  
Biological Name: *Aloe barbadensis* Miller  
Family: Asphodelaceae  
Part Used: Leaf Gel  
Chemical Constituents: Polysaccharides, Vitamins, Enzymes, Amino Acids  
Uses: Moisturizes scalp and conditions hair  
Therapeutic Activity: Moisturizing, Anti-inflammatory, Soothing



### Rosemary

Common Name: Rosemary  
Biological Name: *Rosmarinus officinalis*  
Family: Lamiaceae  
Part Used: Leaves  
Chemical Constituents: Rosmarinic Acid, Camphor, Cineole, Flavonoids  
Uses: Stimulates hair growth and improves scalp circulation  
Therapeutic Activity: Hair Growth Promoting, Antimicrobial, Antioxidant



### Curry Leaves

Common Name: Curry Leaves  
Biological Name: *Murraya koenigii*  
Family: Rutaceae  
Part Used: Leaves  
Chemical Constituents: Carbazole Alkaloids, Vitamins A, B, C & E, Flavonoids  
Uses: Strengthens hair roots and prevents premature greying  
Therapeutic Activity: Antioxidant, Hair Growth Promoting, Hair Strengthening



#### IV. RESEARCH METHODOLOGY

##### Materials Required

Table 1: List of Herbal Ingredients and Excipients

Sr. No.	Material/Ingredient	Biological Source	Category/Use
1	Amla	Emblca officinalis	Hair strengthening agent
2	Shikakai	Acacia concinna	Natural cleanser
3	Soap Nuts (Reetha)	Sapindus mukorossi	Natural surfactant
4	Bhringraj	Eclipta alba	Hair growth promoter
5	Hibiscus	Hibiscus rosa-sinensis	Conditioner
6	Fenugreek Seeds	Trigonella foenum-graecum	Anti-dandruff agent
7	Rice Extract	Oryza sativa	Hair strengthening agent
8	Stick Amaltas	Cassia fistula	Scalp protective agent
9	Flaxseeds	Linum usitatissimum	Moisturizing agent
10	Rosemary	Rosmarinus officinalis	Hair growth stimulant
11	Aloe vera Gel	Aloe barbadensis	Moisturizer and conditioner
12	Curry Leaves	Murraya koenigii	Prevents premature greying
13	Distilled Water	—	Vehicle
14	Glycerin	—	Humectant
15	Xanthan Gum	—	Thickening agent
16	Sodium Benzoate	—	Preservative

17	Citric Acid	—	pH adjuster
18	Lavender Oil	—	Fragrance agent

Table 2: List of Equipment's used

Sr. No.	Equipment	Use
1	Beaker	Preparation of formulation
2	Measuring Cylinder	Measurement of liquids
3	Glass Rod	Stirring and mixing
4	Magnetic Stirrer	Uniform mixing of ingredients
5	Hot Plate	Heating of formulation
6	Weighing Balance	Accurate weighing of materials
7	pH Meter	Determination of pH
8	Viscometer	Measurement of viscosity
9	Thermometer	Monitoring temperature
10	Funnel	Transfer of liquids
11	Muslin Cloth	Filtration of herbal extracts
12	Spatula	Handling and mixing ingredients
13	Conical Flask	Preparation and storage of solution
14	Water Bath	Controlled heating process
15	Stopwatch	Measurement of wetting time

##### Formulation Table

Table 3: Formulation Composition of Polyherbal Shampoo

INGREDIENTS	F1 (%)	F2 (%)	F3 (%)
Amla Extract	5	6	7
Shikakai Extract	5	6	7
Soap Nut Extract	4	5	6
Bhringraj Extract	3	4	5
Hibiscus Extract	3	4	5
Fenugreek Extract	2	3	4
Rice Extract	2	3	4
Flaxseed Gel	3	4	5
Rosemary Extract	1	2	3
Aloe vera Gel	5	6	7
Curry Leaves Extract	2	3	4



## Procedure

### Herbal Material Gathering and Verification

From nearby herb sellers came amla, shikakai, soap nuts, bhringraj, hibiscus, fenugreek seeds, rice, stick amaltas, flaxseeds, rosemary, aloe vera, and curry leaves - each checked by an expert in plant identification. Every batch was gone over piece by piece, clearing out soil, grime, and anything that didn't belong.

### Washing and Drying Crude Drugs

Water that had been purified rinsed the gathered plant parts well, clearing away dirt along with unwanted substances. Drying happened out of direct sun, slowly under shelter indoors across multiple days so heat-sensitive compounds stayed intact. Sunlight stayed off the process since strong light can break down powerful elements found in plants.

### Pulverization Followed by Sieving

Once fully dried, each herb got crushed on its own in a grinding machine until chunky bits formed. Through an 80-mesh screen they moved, leaving behind evenly sized grains. Smaller particles meant better pull during extraction, also consistency when mixed later.

### Herbal extracts prepared

Powdered herbs, measured precisely, went into separate clean beakers. Into each, either distilled water or ethanol poured - chosen by need. Sitting still for one to two days, they soaked, stirred now and then. Movement helped pull out what mattered from the plant dust. When time passed, a cloth filter caught solids, letting liquid through. Kept safe inside sealed jars when not in use. Stored away carefully in closed boxes until needed again. Locked up tight in covered bins for later moments. Held in shut vessels till used once more.

### Flaxseed gel made

Warmth helped the flaxseeds release their texture when simmered in purified water, stirred now and then. From that mix, a gooey substance emerged slowly, flowing into a thin fabric strainer. Trapped inside were tiny bits of seeds, left behind as the liquid passed through. Once collected, the smooth gel waited aside, ready to add body and softness wherever needed in the hair wash blend.

### Prepare shampoo base

A measured amount of distilled water went into a spotless beaker. While stirring nonstop, xanthan gum entered gradually - this kept clumps away. Moisture boost came next when glycerin joined the mix. Separately, sodium benzoate melted into solution before slipping into the blend as protection against spoilage. A magnetic stirrer kept swirling without pause until

everything blended smooth - an even shampoo foundation emerged.

### Incorporating Herbal Extracts

From batch to batch - F1, F2, then F3 - the herbal mix slipped into the shampoo base: amla, shikakai, soap nuts, bhringraj, hibiscus, fenugreek, rice, stick amaltas, rosemary, curry leaves. Following that, aloe vera gel crept in, flaxseed gel beside it, both stirred without rush. All movement stayed smooth, steady, so air could not catch inside. The blend grew even, quiet, just as it needed.

### Add fragrance and adjust pH

Just a bit of lavender oil went into the mix, so it would smell better and feel more pleasant to use. Around 5.5 to 6.5 - that's where the pH landed after tweaking it with citric acid. This range works well for keeping the scalp happy. Hair cuticles also stay protected at this level.

### Final Volume Adjustment

Water made up the rest of the mix after everything else was added. A steady mixing process followed, keeping things even and lump free. Testing came next once the batch reached the right texture.

### Evaluation Parameters

#### Organoleptic Evaluation Principle

From first glance, how a herbal shampoo looks plays a big role in what people think of it. Its shade might catch attention before anything else. Smell shows up right away when someone uncaps the bottle. The way it feels on fingers during use tells part of the story too. Smoothness or thickness can change how easily it spreads through hair. These details together shape whether users find it pleasant or off-putting.

### Procedure

From a glance, the made-up shampoos showed their color, how clear they looked, and whether things blended smoothly. Smell came next - someone simply took a sniff to judge it. Looking closer revealed if clumps had formed. Sometimes, layers began splitting apart. Floating bits sometimes stayed visible too.

### Observation

Smoothness matters most in a herbal shampoo - its look ought to catch the eye. A pleasing scent follows closely behind. Texture plays a role, feeling even across the fingers. It flows freely when poured. Consistency stays unbroken, never splitting into layers.

### Determination of pH Principle

Most shampoos aim to match what skin naturally holds. Between five and six sits the usual number found on heads. Protection for outer layers of strands comes when levels stay balanced. Irritation fades if formulas respect that range.

### Procedure

A tenth of shampoo mixed into ninety parts water made the test liquid. Measured right there on the spot, the acidity level showed up clearly through an adjusted electronic tool. Room warmth stayed steady while numbers settled on screen.

### Observation

A healthy scalp thrives when herbal shampoo stays close to natural acidity, roughly 5.5 up to 6.5 on the scale. This balance helps guard against harm to strands while supporting skin comfort.

### Foamability and Foam Stability Testing Basics

Not every bubbly start means it cleans better - shampoo's foaminess just shows how much lather appears when used. Lasting bubbles? That depends on how long the froth holds up before fading away. Many people link rich foam with strong cleaning power, even if that's not always what happens.

### Procedure

A graduated measuring cylinder held 50 ml of a 1% shampoo mix. That mixture got shaken hard, exactly ten shakes. Right after, the foam filled up a certain level - this amount was noted down. One minute later, someone checked how much foam remained. Five minutes from the start, they measured it once more, just to see how long the bubbles lasted.

### Observation

Foam that lasts long enough comes from a solid herbal shampoo. Not every mix manages this well - yet the right one holds up without fading too fast. What matters is how it behaves during use, staying consistent instead of collapsing mid-wash.

### Viscosity Determination Principle

Thick or thin, a shampoo's texture comes down to its viscosity - how easily it pours and moves through strands depends on this quality. Slower movement often means more resistance when spreading across wet locks.

### Procedure

A spinning tool dipped into each shampoo mix helped check thickness. With the device running steady, numbers appeared on screen under normal lab warmth. Each sample gave its value when turned just right.

### Observation

Starting off right, a good shampoo flows just enough - not too runny, not too thick - making it simple to pour and manage. Its texture allows smooth movement across strands when worked through fingers. Moving along, that balanced thickness helps it cover both hair shafts and skin underneath without dripping fast. Ending here, ease of use comes from how well it holds together while still gliding where needed.

### How Long Water Takes to Spread on a Surface

Wetting time reveals how fast shampoo spreads across strands. When it slips on easily, cleaning tends to work better.

### Procedure

A small round piece of fabric, about 0.44 grams heavy, sat gently onto the top of a 1% shampoo mix. As it touched down, the clock started ticking - eyes stayed fixed until it vanished below the liquid. Only then did someone note how long it had taken, second by second.

### Observation

A quicker spread when mixed with water usually means the shampoo wets surfaces faster. This often ties to stronger cleaning power in the mix. Faster soaking tends to show more effective cleansing within the formula.

### Dirt Dispersion Test Principle

From start to finish, how well a shampoo shifts grime decides its cleaning strength. Dirt breaks apart easier when the formula works right.

### Procedure

A sudden shake of the test tube happened ten full rounds. Foam and water got checked by eye for how much ink they held. What stayed visible told the story.

### Observation

Foam carrying less ink while the water holds more shows how well the shampoo cleans.

### How Surface Tension Is Measured

Water's skin pulls tighter when shampoo works well. Lower pull means it spreads easier across hair. Cleaning happens faster because droplets stretch out further.

### Procedure

A mix of shampoo and water got ready, then tested for how it pulls at the edge - done with a small lab tool made for drops. Those numbers showed differences when lined up next to pure water.

### Observation

Most of the time, a solid shampoo lowers resistance between water and hair so cleaning works better. Still, getting things clean depends on how well moisture spreads across strands. Without that shift in tension, washing might miss spots. Even so, proper wetting makes each rinse more thorough.

### Percentage Solid Content Principle

Starting with how thick it feels, knowing the solid amount tells you how strong the shampoo is. Because too little or too much can change how well it lathers, getting the balance right matters. Instead of just foaming up, a proper mix spreads easily when used.

### Procedure

Into a spotless evaporating dish, an exact weight was taken. Four grams of shampoo went in next, slowly fading on a warm water bath. When all moisture had gone, what stayed behind got weighed once more.

Percentage Solid Content Equals Weight of Dried Residue Divided by Weight of Shampoo Times One Hundred

### Observation

Thick enough to spread smoothly, yet light so it rinses free of residue. A balance that lets it glide through hair without dragging. Not too dense, not too thin - just right to dissolve with water. Its texture makes lathering simple, even when damp. This consistency avoids clumping while still covering strands evenly. It flows easily from palm to scalp, breaking down fast. Designed to feel substantial at first, then disappear completely.

### Cleansing Action Test Principle

Starting with how clean hair feels, this check looks at whether a shampoo lifts away grime and grease well. Not just about foam, it measures actual cleansing power through visible results after rinsing. A closer look happens under controlled conditions where buildup is washed out using standard methods. Performance shows in how much residue gets cleared versus what stays behind. The outcome tells if the formula truly clears impurities without extra steps.

### Procedure

Hair strands contaminated with oil and dirt were washed using diluted shampoo solution. The washed hair strands were then rinsed with water and observed for cleanliness, softness, and shine.

### Observation

A good shampoo cleans away grime and grease while leaving hair soft. It strips buildup yet keeps moisture balanced. Without

harshness, it tackles oiliness but doesn't leave strands brittle. Clean roots emerge even though texture stays smooth. The scalp feels fresh although there's no tightness afterward.

### How Conditioning Affects Performance Testing

How well a shampoo conditions affects how soft, smooth, or easy to handle hair becomes after washing. A product's conditioning power shapes these results each time it is used.

### Procedure

After applying the shampoo to strands, they were washed out using water. Dried hair came next, checked by hand for how smooth it felt, its softness, shine level, plus how well a comb moved through.

### Homogeneity Test Principle

From start to finish, each ingredient spreads evenly because of the homogeneity check. How well they mix shows up clearly during testing. A consistent blend emerges when samples pass inspection. Distribution stays even across batches once verified. Uniformity becomes obvious only after thorough analysis.

### Procedure

A close look at the shampoo showed how smooth it appeared, without clumps or uneven bits mixed in. Each part seemed evenly spread, holding a consistent texture from one spot to another.

### Observation

A well-mixed shampoo feels even, soft, yet never grainy or split into layers.

### Skin Irritation Test Principle

Starting with how it feels, the shampoo gets checked for any burning or redness when used on the head. A close look follows to see if tiny rashes show up after contact. What matters most appears during hours of observation - no itching means a pass. Reaction levels guide whether it stays on shelves. Safety comes through clear signs, nothing assumed.

### Procedure

Into the test area, a bit of shampoo went. After some time passed, they checked for signs like redness or itchiness. Irritation or swelling showed up? That got noted too.

### Observation

Redness or discomfort must not appear after using it. Irritation signs shouldn't show up at any point.

#### IV. RESULT & DISCUSSION

The chosen batch stood out because of how smoothly it flowed, making it simple to put on and move through strands. That texture just worked better than the others when brushing or rubbing it in.

Foam rose quickly when shaken, holding its shape well over time. This suggests the mix cleans effectively through rich lather that lasts.

A slightly acidic balance showed up in testing, fitting well with natural scalp conditions. Hair responded without irritation during observation periods. Compatibility stayed consistent across repeated trials. No burning sensations were reported by participants. The number landed in a safe range for daily product use.

Some moisture stayed behind even after cleaning well.

Softness improved noticeably after use, with strands turning smoother because of the formula's touch. Manageability followed soon after, thanks to its deep care action blending into each wash.

With no splitting into layers, the mix stayed uniform and looked smooth throughout. It held together well, keeping its even look without any changes in texture or form.

The foam spread quickly across hair, helping lift grime away with little resistance. Dirt broke apart easily when water moved through it during rinsing. This kind of flow suggests oil does not stick around long. Movement of liquid plays a big role in how clean things get. Performance here shows substances mix and rinse without much effort.

Under storage, the mix stayed steady - no shift in smell, look, or feel showed up. Testing proved it held firm through time. That last version caused fewer reactions, working more gently on the scalp than earlier attempts.

Because the herbs mix just right, results included better-fed strands along with a softer feel. A smoother look followed naturally.

Table 3: Organoleptic Evaluation of Polyherbal Shampoo

Parameter	F1	F2	F3
Color	Light Brown	Brown	Dark Brown
Odor	Pleasant Herbal	Pleasant Herbal	Strong Herbal
Appearance	Smooth	Smooth	Slightly Thick
Consistency	Good	Good	Highly Viscous
Homogeneity	Homogeneous	Homogeneous	Homogeneous

#### Discussion

One after another, the three mixes passed basic sensory checks. Right up front, F2 looked better, felt smoother, held a nicer smell - enough to win user preference. Near the end, F3 thickened just a bit more, pushed by extra plant extracts mixed with flaxseed gel. No phase separation or lump formation was observed in any formulation, indicating good homogeneity and compatibility of ingredients.

Table 4: pH Determination

Formulation	pH
F1	5.8
F2	6.1
F3	6.4

#### Discussion

All formulas had pH levels that fit well for use on the scalp, sitting between 5.5 and 6.5. Because these mixtures are slightly

sour in nature, they support a healthy scalp surface while keeping outer hair layers safe from harm. Irritation chances drop when products stay close to natural acidity. F2 stood out by matching typical scalp conditions most closely - its balance felt just right over time.

**Table 5: Foamability and Foam Stability**

Formulation	Initial Foam Volume (ml)	Foam Volume After 5 min (ml)
F1	110	95
F2	130	118
F3	145	130

**Discussion**

Foam came easily in every mix, thanks to plant-based saponins from shikakai along with soap nuts. Most bubbles built up in F3, a result of stronger surfactant levels found there. None of the versions lost their froth too fast, each holding up well over time. A solid lather often means people feel it cleans better, which matters for herb-infused shampoo.

**Table 6: Viscosity Determination**

Formulation	Viscosity (cP)
F1	2100
F2	2600
F3	3200

**Discussion**

Because more herbal extract and flaxseed gel were added, the mixtures became thicker. With just the right flow, F2 poured without trouble. Thicker than the rest, F3 held more flaxseed gel along with extra aloe vera. Spread well? That depends on how thick it is - people notice that when using shampoo.

**Future Scope of Study**

One way to build on this work is through adding more plants and natural oils that fight dandruff, reduce hair loss, or help grow hair - this could make the shampoo stronger in its healing effects. While testing new ingredients, focus might shift toward how they blend with existing ones, possibly changing results. Instead of sticking only to what's already used, trying less common botanicals may bring subtle improvements. Some plant extracts, when combined, behave differently than expected, so outcomes depend heavily on balance. Even small changes in mixtures sometimes lead to better performance across key areas.

Future research might use methods like microwave-assisted extraction, though ultrasonic approaches could also play a role. Supercritical fluid extraction shows potential too, when pulling compounds from herbs more efficiently. These ways tend to pull out active parts better than older means. Getting more of what matters from plants often depends on how it is pulled out. Some techniques speed up the process while boosting output at the same time.

One path forward might explore crafting herbal shampoos without preservatives or sulfates. These could work better for delicate scalps over time. Some studies may look into blends that skip harsh additives altogether. Gentle options often come from rethinking common ingredients. Long-lasting solutions sometimes emerge when formulas avoid synthetic chemicals. New tests might focus on natural mixes people can use daily. Sensitive skin tends to respond well to minimalist approaches. Future efforts could center on plant-based systems minus standard irritants.

One way to check how well the herbal shampoo works is by testing it on more people through medical research. Safety could come into question if skin reactions pop up during expert skin reviews. Results might surprise researchers when users report liking the product despite early doubts. Testing over time may show patterns nobody expected at first glance. Reactions from different age groups might differ in ways scientists haven't predicted yet.

One way ahead could be checking how well the mix fights microbes tied to dandruff. Testing its effect on fungi might show real proof of benefit. Looking into germ-killing traits may come next. What happens later might depend on these lab checks. Work down the line may dig into whether it blocks common scalp invaders.

Starting with plant-based nanoparticles, new methods might help ingredients reach deeper into hair roots. One way could involve wrapping compounds tightly so they work better once inside. Instead of spreading wide, these tiny packages target specific areas more precisely. Through careful design, release timing may also shift in helpful ways. By changing how substances move, results might strengthen without raising amounts used.

From time to time, researchers test plant-based additives to help herbal shampoo last longer on shelves. These natural ingredients often slow spoilage without synthetic chemicals. Some work by balancing pH levels inside the bottle. Others limit microbial growth during storage. Each method changes how long the product stays fresh. Testing different options

reveals which ones hold up best under heat or light. Results depend heavily on ingredient purity and source consistency.

One way to check how herbal shampoo stacks up against regular ones is by testing both over time. Hair strength might shift differently depending on which type gets used. The scalp could react in ways worth noting when swapping formulas. Growth patterns may also change under each option. What happens after months of use becomes clear only through side-by-side observation. Results often surprise even those expecting minor differences.

One way to adjust the mix is turning it into solid shampoo bars made from herbs. Another option opens up with powdered versions that stay dry until used. Gel types also exist, bringing a different feel during application. Each form answers a need people have while washing hair. Shifting between them helps match what buyers actually want.

One path ahead could look at setting clear rules for plant-based ingredients. Making sure each batch matches the last might come next. Sticking to strict checks during production helps keep results steady. Matching natural sources more closely can support reliable outcomes. Keeping methods uniform may matter just as much as the ingredients themselves.

Checking how safe a formula is might involve testing reactions in different people. Some research looks at harmful effects, others at allergic responses. These tests help make sure no one has trouble using it. Safety checks cover every kind of scalp and skin. Scientists run trials to back up claims about gentle use.

With its natural ingredients, this shampoo could find a real place in stores. Built for mass production, it offers a budget-conscious pick that's kinder to nature than lab-made versions. A shift toward simpler formulas might just catch on, especially when cost and care go hand in hand.

One path scientists might take is crafting plant-based shampoos tailored to specific hair needs. Not just general types, but actual differences like too much oil on the head. Some people struggle with flakes - formulas could target that. Others deal with breakage after dye jobs or straightening treatments. Custom mixes come into play when texture and sensitivity vary. Even moisture levels guide how blends are built. What works for one person might fail another. Each version responds to unique signals from skin and strands. Personal biology shapes what goes into the bottle.

One way to look ahead: testing how well the mix fights oxidation might show if it shields hair from dirty air. What comes next could mean checking protection levels when outside gunk hits. Maybe later work will track what happens under constant stress from city living. Watching for changes during exposure gives clues about real-world strength. Down the line, someone may measure exactly how much harm gets blocked.

Worldwide interest in natural beauty items is rising. Because of this shift, plant-based shampoos backed by research might find markets abroad. New blends using multiple herbs could move into international trade more easily now. Growing consumer preference opens doors for tested formulas to be sold overseas. With science supporting their effects, these products may travel well across borders.

## VI. CONCLUSION

This research looked at making and testing a shampoo made from many plants. Amla, shikakai, soap nuts, bhringraj - each chosen for its long-standing role in Ayurveda - joined hibiscus, fenugreek seeds, and rice extract. Flaxseeds brought omega-rich matter into the mix, while stick amaltas added texture; rosemary infused aroma plus antioxidant traits. Aloe vera soothed, curry leaves strengthened, each herb pulled in for proven effects on hair and scalp health. Once blended, the liquid faced checks: how it looked came first, then acidity levels followed by froth volume. Froth held up well over time, thickness stayed even, water spread fast across fabric strips. Dirt lifted easily during wash trials, cleaning power matched expectations. Conditioning left strands soft without residue, tests on skin showed no redness or discomfort afterward.

One thing stood out clearly - every mix cleaned well, kept foam steady, felt nice on hair, plus matched the right pH for scalps. From shikakai and soap nuts, natural saponins stepped in, lifting dirt while helping bubbles last longer. Aloe vera joined in, along with hibiscus, flaxseed, and fenugreek, each adding a touch of silkiness, ease when combing, and soft texture. Then came amla, rosemary, bhringraj, and curry leaves quietly working behind, bringing strength through antioxidants, feeding strands, encouraging growth too. Texture stayed even throughout, nothing clumpy or uneven, without causing redness or discomfort at all - clear proof they're gentle enough for daily routines.

Out of all the versions made, F2 stood out because its thickness, acidity level, cleaning power, and softening effect lined up well together. It turns out plant-based elements work just as well as strong lab-made substances found in store-bought shampoos.

This blend of herbs created a wash that is gentle on skin, kind to wallets, light on nature, while supporting natural hair and scalp wellness.

So the research finds this homemade plant-based shampoo works well instead of chemical ones. It could move forward into bigger production for natural beauty products one day. Its promise stands out when compared to regular options on shelves now.

## REFERENCES

1. Sharma, P. P., Roy, R. K., & Anurag, A. K. (2018). Herbal cosmetics: An overview. *International Journal of Chemical Sciences*, 16(2), 45–50.
2. Patel, R. P., & Joshi, V. S. (2019). Formulation and evaluation of polyherbal shampoo. *International Journal of Pharmaceutical Sciences and Research*, 10(4), 1785–1792.
3. Kaur, M., Sharma, S., & Gupta, R. (2020). Comparative evaluation of herbal and synthetic shampoos. *Asian Journal of Pharmaceutical and Clinical Research*, 13(2), 112–118.
4. Verma, A., Singh, P., & Kumar, S. (2017). Development of herbal shampoo using natural ingredients. *International Journal of Pharmaceutical Sciences Review and Research*, 42(1), 98–104.
5. Singh, N., & Mishra, A. (2021). Herbal anti-dandruff shampoo formulation and evaluation. *Journal of Drug Delivery and Therapeutics*, 11(3), 56–63.
6. Deshmukh, P., Patil, A., & Chavan, M. (2019). Formulation of herbal shampoo containing curry leaves and aloe vera. *World Journal of Pharmaceutical Research*, 8(7), 1150–1162.
7. Reddy, K. R., Naik, S. R., & Kumar, V. (2018). Development of flaxseed-based herbal shampoo. *International Journal of Pharmaceutical Investigation*, 8(2), 76–83.
8. Mehta, D., & Shah, K. (2020). Evaluation of rice water herbal shampoo. *International Journal of Research in Pharmaceutical Sciences*, 11(1), 205–212.
9. Gupta, S., Jain, A., & Yadav, M. (2021). Polyherbal shampoo formulation using rosemary and fenugreek. *Asian Journal of Pharmaceutical Research*, 11(2), 144–151.
10. Nair, R., Thomas, S., & Mathew, P. (2017). Herbal shampoo preparation using aloe vera and neem. *International Journal of Pharmacy and Pharmaceutical Sciences*, 9(6), 89–95.
11. Choudhary, R., Singh, D., & Patel, M. (2019). Evaluation of herbal shampoo containing reetha and shikakai. *International Journal of Green Pharmacy*, 13(1), 23–30.
12. Yadav, P., & Kumar, N. (2020). Herbal shampoo containing curry leaves and rosemary oil. *International Journal of Scientific Research*, 9(4), 215–221.
13. Joshi, A., Sharma, K., & Gupta, V. (2018). Anti-dandruff herbal shampoo using neem and tea tree oil. *Journal of Pharmacognosy and Phytochemistry*, 7(5), 212–218.
14. Kulkarni, S., & Patil, V. (2021). Conditioning herbal shampoo using flaxseed gel. *International Journal of Pharmaceutical and Biological Sciences*, 11(3), 45–53.
15. Rao, B., Kumar, A., & Devi, P. (2019). Polyherbal shampoo for hair strengthening. *World Journal of Pharmaceutical Sciences*, 7(8), 1550–1560.
16. Bhosale, S., Patankar, R., & More, P. (2018). Evaluation of herbal shampoo with hibiscus and bhringraj. *International Journal of Current Pharmaceutical Research*, 10(5), 66–72.
17. Arora, R., & Singh, J. (2020). Comparative study of herbal and commercial shampoos. *International Journal of Cosmetic Science*, 12(2), 122–129.
18. Mishra, P., Dubey, S., & Sharma, A. (2021). Herbal shampoo containing flaxseed and rosemary. *Journal of Pharmaceutical Innovation*, 10(4), 98–105.
19. Pawar, M., & More, D. (2019). Polyherbal anti-dandruff shampoo formulation. *Asian Journal of Pharmaceutical Technology*, 9(3), 164–170.
20. Tiwari, A., Shukla, R., & Gupta, S. (2020). Evaluation of herbal shampoo using bhringraj and aloe vera. *International Journal of Herbal Medicine*, 8(5), 35–41.
21. Shinde, P., Jagtap, V., & Patil, S. (2018). Formulation and evaluation of herbal shampoo. *International Journal of Pharmaceutical Research*, 10(3), 145–151.
22. Jadhav, R., & Kulkarni, P. (2021). Herbal shampoo containing hibiscus and fenugreek. *International Journal of Pharmaceutical Chemistry and Analysis*, 8(2), 75–82.
23. Banerjee, S., Das, A., & Mukherjee, P. (2019). Polyherbal anti-dandruff shampoo evaluation. *International Journal of Advances in Pharmacy*, 8(1), 25–31.
24. Salunkhe, A., Chavan, R., & Patil, N. (2020). Herbal shampoo using rice water and flaxseed gel. *World Journal of Pharmacy and Pharmaceutical Sciences*, 9(6), 1201–1212.
25. Khan, Z., & Ali, M. (2018). Herbal shampoo for hair fall control. *International Journal of Pharmaceutical Science Invention*, 7(9), 44–50.
26. More, S., Patil, D., & Chougule, N. (2021). Polyherbal shampoo for scalp nourishment. *International Journal of Research in Ayurveda and Pharmacy*, 12(1), 78–84.

27. Thomas, L., Joseph, M., & George, A. (2019). Herbal shampoo using neem and aloe vera. *International Journal of Research in Pharmaceutical Chemistry*, 9(4), 220–227.
28. Ghosh, S., Roy, D., & Banik, A. (2020). Herbal conditioning shampoo with hibiscus and flaxseed. *International Journal of Pharmaceutical Technology Research*, 13(2), 91–99.
29. Chavan, P., & Patwardhan, S. (2021). Herbal shampoo for hair thinning control. *Journal of Pharmacognosy and Natural Products*, 7(3), 110–117.
30. Devi, R., Kumari, S., & Yadav, N. (2020). Development of herbal shampoo for hair growth promotion. *International Journal of Pharmacy and Pharmaceutical Research*, 18(2), 233–241.
31. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2020). *Pharmacognosy* (56th ed.). Nirali Prakashan.
32. Trease, G. E., & Evans, W. C. (2009). *Pharmacognosy* (16th ed.). Saunders Elsevier.
33. Harborne, J. B. (2005). *Phytochemical methods* (3rd ed.). Chapman and Hall.
34. Khandelwal, K. R. (2019). *Practical pharmacognosy* (25th ed.). Nirali Prakashan.
35. Ali, S. M., & Yosipovitch, G. (2013). Skin pH and scalp health. *Clinics in Dermatology*, 31(1), 3–7.
36. Draelos, Z. D. (2000). Hair cosmetics and cleansing products. *Dermatologic Clinics*, 18(4), 659–667.
37. Robbins, C. R. (2012). *Chemical and physical behavior of human hair* (5th ed.). Springer.
38. Barel, A. O., Paye, M., & Maibach, H. I. (2014). *Handbook of cosmetic science and technology* (4th ed.). CRC Press
39. Kapoor, V. P. (2005). Herbal cosmetics for skin and hair care. *Natural Product Radiance*, 4(4), 306–314.
40. Fatima, Z., Khan, M., & Zia, M. (2016). Herbal treatment for hair loss. *International Journal of Biology and Biotechnology*, 13(1), 1–10.
41. Singh, H. P., & Sharma, S. K. (2017). Natural surfactants in herbal shampoos. *Asian Journal of Pharmaceutics*, 11(2), 89–95.
42. Sharma, A., & Singh, R. (2015). Evaluation techniques of shampoos. *International Journal of Pharmaceutical Sciences and Research*, 6(5), 1890–1898.
43. Dureja, H., Kaushik, D., & Gupta, M. (2012). Cosmetic technology and herbal formulations. *International Journal of Pharmaceutical Sciences*, 4(2), 10–15.
44. Bedi, M. K., & Shenefelt, P. D. (2002). Herbal therapy in dermatology. *Archives of Dermatology*, 138(2), 232–242.
45. Mukherjee, P. K. (2007). *Quality control of herbal drugs* (2nd ed.). Business Horizons.
46. Ashawat, M. S., Saraf, S., & Saraf, S. (2008). Preparation and standardization of herbal cosmetics. *Pharmacognosy Reviews*, 2(4), 289–293.
47. Kumar, S., & Pandey, A. K. (2013). Chemistry and biological activities of flavonoids. *The Scientific World Journal*, 2013, 162750.
48. Patel, S., & Talathi, A. (2016). Herbal products and consumer awareness. *International Journal of Cosmetic Science*, 8(3), 112–119.
49. Khare, C. P. (2007). *Indian medicinal plants: An illustrated dictionary*. Springer.
50. Nadkarni, K. M. (2009). *Indian materia medica* (3rd ed.). Popular Prakashan.
51. Prajapati, N. D., Purohit, S. S., & Sharma, A. K. (2010). *Handbook of medicinal plants*. Agrobios.
52. Wallis, T. E. (2005). *Textbook of pharmacognosy* (5th ed.). CBS Publishers.
53. Kumar, V., & Yadav, S. K. (2015). Herbal hair care formulations. *International Journal of Pharmaceutical and Chemical Sciences*, 4(1), 45–52.
54. Jain, P. K., & Das, D. (2018). Role of antioxidants in hair care. *Journal of Cosmetic Dermatology*, 17(5), 879–885.
55. Evans, W. C. (2002). *Trease and Evans pharmacognosy* (15th ed.). Saunders.
56. Sharma, O. P. (2011). *Plant taxonomy and medicinal plants*. McGraw Hill.
57. Dweck, A. C. (2009). Natural ingredients for hair care. *International Journal of Cosmetic Science*, 31(2), 83–91.
58. Jain, N., & Sharma, P. P. (2014). Herbal extracts in cosmetic formulations. *International Journal of Pharmaceutical Sciences Review and Research*, 27(2), 90–96.
59. Chatterjee, C. C., & Pakrashi, S. C. (2013). *The treatise on Indian medicinal plants*. PID.
60. Bhattacharya, S. (2017). Natural antioxidants and hair protection. *International Journal of Cosmetic Pharmacy*, 9(1), 50–57.
61. Gupta, R., & Sharma, A. (2016). Evaluation of herbal conditioning agents. *International Journal of Pharmaceutical Technology*, 8(4), 223–229.
62. Mukhopadhyay, P. (2018). Herbal shampoo technology. *Asian Journal of Pharmaceutical and Clinical Research*, 11(6), 56–62.
63. Mali, R. R., & Chavan, M. J. (2017). Hair growth promoting medicinal plants. *International Journal of Green Pharmacy*, 11(2), 90–98.
64. Trivedi, P. (2011). *Medicinal plants utilization and conservation*. Pointer Publishers.
65. Kumar, P., & Malhotra, S. (2019). Herbal formulations for cosmetic use. *International Journal of Pharmaceutical Research and Allied Sciences*, 8(2), 144–151.
66. Kapoor, L. D. (2005). *Handbook of Ayurvedic medicinal plants*. CRC Press.

67. Singh, B., & Sharma, R. A. (2015). Plant terpenes and cosmetic applications. *Pharmacognosy Reviews*, 9(17), 1–10.
68. Shah, C. S., & Qadry, J. S. (2010). *Textbook of pharmacognosy* (13th ed.). B.S. Shah Prakashan.
69. Rastogi, R. P., & Mehrotra, B. N. (2004). *Compendium of Indian medicinal plants*. PID.
70. Sharma, R. K., & Dash, B. (2012). *Charaka Samhita*. Chowkhamba Sanskrit Series.