EPH-International Journal of Educational Research
ISSN (Online): 2208-2190
Volume 11 Issue 03 September 2025

DOI: https://doi.org/10.53555/7rp0me98

DEVELOPMENT OF A DEEP-MOISTURIZING HERBAL SHAMPOO FOR DRY AND FRIZZY HAIR USING OKRA (ABELMOSCHUS ESCULENTUS) MUCILAGE: A NATURAL ALTERNATIVE TO SYNTHETIC SHAMPOOS

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Abstract

This research paper develops and evaluates a herbal, deep-moisturizing shampoo tailored for dry and frizzy hair, using okra (Abelmoschus esculentus) mucilage as the primary green conditioning agent. Okra mucilage was extracted aqueously and combined with traditional Ayurvedic surfactants and conditioners like soap nut (reetha), shikakai, amla, aloe vera, and, in one formula, the mild nonionic surfactant decyl glucoside. The formulations were tested via standard shampoo quality tests (pH, total residue , viscosity, surface tension reduction, foam stability, cleansing, wetting time) and a user perception survey. The okra-based shampoos showed effective cleansing, stable foam, desirable viscosity, and desirable surface-tension reduction. Users claimed high to moderate improvements in softness, manageability, and frizz reduction. The data support okra mucilage as a promising, sustainable alternative to synthetic conditioning systems for textured, dry, and frizzy hair, with further work recommended on preservation, stability, and instrumental performance standardization.

Keywords*: okra mucilage, herbal shampoo, saponins, decyl glucoside, frizz control, moisturization, surface tension, rheology*

1. Introduction

Demand for plant-derived and environmentally friendly cosmetics is increasing as consumers search for natural alternatives to formulations which are stifled by harsh surfactants, silicones and microplastics. Hair characteristics are significantly determined by cuticle status and cortex bond; when the hydrophobic layer is worn away and the scales lift, the hair is rough, dull and suffers frizz and splits, which is acute in dry hair. Gentle cleansing and film-forming green polymers can contribute to reconstituting smoothness, decreasing resistance and reducing moisture loss.

Okra (Abelmoschus esculentus) mucilage is a polysaccharide-rich, high-molecular-weight hydrocolloid with hydration, viscosity-modifying, and film-forming properties desirable in rinse-off hair care. Traditional Ayurvedic plant-based products soap nut (Sapindus mukorossi) and shikakai (Acacia concinna) provide saponin-based mild cleansing with less scalp irritation compared to harsh chemicals, while amla (Phyllanthus emblica) and aloe vera contribute antioxidant and soothing benefits. This study leverages these combinations to design a deep-moisturizing shampoo for dry, frizzy hair and evaluates its physicochemical performance and user acceptance.

Objectives:

- Formulate an okra-mucilage herbal shampoo for dry, frizzy hair.
- Determine physicochemical quality and cleansing/conditioning performance.
- Assess user perception and acceptance.

Hypothesis:

- Addition of okra mucilage into a balanced herbal shampoo enhances moisturization, manageability, and frizz control while maintaining adequate cleansing and pleasant odor.

2. Literature Review

Cuticle smoothness and its integrity control shine; friction and strength acidic to neutral pH and deposition of conditioning agents reduce swelling and roughness, improving smoothness and gloss. Synthetic vs herbal shampoos: Sulfates cleanse effectively but can increase dryness and irritation, particularly with frequent use. Herbal shampoos employing plant saponins and milder nonionic surfactants can achieve acceptable detergency with better scalp comfort. Numerous evaluations report herbal formulations meeting key quality parameters (pH, foam, surface tension, detergency) similar to synthetic comparators. Prior work has formulated okra-extract shampoos (including low-foam variants) with good stability and cleansing, highlighting mucilage's viscosity control and potential conditioning benefits. Soap nut and shikakai provides natural surfactants like saponins for gentle cleansing; amla gives antioxidant properties and balances scalp health, aloe vera has soothing properties and hydrates scalp too. Along with that, neem provides antimicrobial and anti-inflammatory action which supports scalp health.

3. Materials and Methods

3.1 Materials and Functional Roles

- Okra mucilage: film-forming agent, viscosity modifier, and moisturising agent.
- Soap nut (Reetha): gentle cleanser and foaming agent containing saponin.
- Shikakai (Acacia concinna): mild cleanser, supports scalp health and detangling.
- Amla (Phyllanthus emblica): antioxidant properties, increases hair strength.
- Aloe vera gel: soothing hydration for scalp.
- Decyl glucoside: mild, biodegradable nonionic surfactant.
- Sodium benzoate: preservative.
- Optional colourant and fragrance: product aesthetics and odour masking.

3.2 Extraction of Okra Mucilage

- Fresh and mature okras were washed and cut and then allowed to soak in distilled water for 10–15 minutes.
- The soaked okras were then boiled for some time.
- The decoction was cooled and filtered through a fine muslin cloth by gentle pressing.
- Mucilage was stored in decontaminated, airtight containers in a cool, dark place.

3.3 Aqueous Extracts of Botanicals

- Shikakai, soap nut, amla, and neem powders were soaked in distilled water, mixed thoroughly, and filtered through muslin to obtain clear extracts.

3.4 Formulation Design

- Two formulas were prepared:
- Formula I (okra mucilage, no decyl glucoside is used, xanthan gum is used for viscosity):

Ingredients	Quantity (100g)
Ingredients	Quantity (100 g)
Okra mucilage	10 g
Soap nut	20 g
Shikakai	20 g
Amla	5.2 g
ALoe vera	5 g
Xanthan gum	0.8 g
Sodium benzoate	0.8 g
Color and fragrance	q.s.
Purified water	Upto 100 g

- Formula II (with decyl glucoside; lower botanicals; no xanthan):

Ingredients	Quantity (100 g)
Okra mucilage	8 g
Soap nut	18 g
Shikakai	18 g
Amla	2 g
ALoe vera	5 g
decyl glucoside	10 g
Sodium benzoate	0.8 g
Color and fragrance	q.s.
Purified water	Upto 100 g

Process:
- Wash all the apparatus properly
- Weigh all the ingredients accurately.
- Add all the filtered extracts in a beaker along with other ingredients.
- Add the remaining substances with gentle stirring to avoid foaming.
- Finished products were filled into clean containers.

3.5 Evaluation Methods
Organoleptic study: color, transparency, odor, foaming ability.
pH: 10% w/v solution at ~25–27°C.
Total residue: 4 g sample dried to constant mass; total residue calculated.
Viscosity: viscometer; shear-rate dependence recorded for flow behavior.
Dirt dispersion: India-ink method; scoring for ink in foam vs water phase.
Surface tension: reduction from water baseline to target detergency range (~32–37 dynes/cm).
Foaming: cylinder shake of 1% solution; foam volume and 5-min retention.
Wetting time: canvas disk method as a surrogate for surfactant efficiency.
User perception: Survey (n = 50) of individuals with dry/frizzy hair assessing moisturization, texture, frizz control, ease of combing, sensorials, and overall effectiveness.

4. Results

4.1 Physicochemical Performance

Appearance and sensorials: Green, opaque shampoo with pleasant odor; produced uniform, small-bubble, dense foam.
pH (10%): ≈ 7.0, consistent with scalp comfort and reduced stinging potential; minor acidification could further compact cuticles.
Solids content: 23.25%, indicating acceptable rinsability and reduced residue risk.
Rheology: Pseudoplastic (shear-thinning) flow—high viscosity at low shear for in-package stability, thinning during application for easy spreading and rinsing.
Dirt dispersion: Ink remained in water phase (not foam), suggesting lower redeposition risk and better rinse-off.
Surface tension: 35.18 dynes/cm (from ~72.8 dynes/cm in pure water), aligned with effective detergency while retaining mildness.
Foam behavior: Initial foam volume above 50 mL with good stability over 5 minutes; small, compact bubbles characteristic of saponin/nonionic systems.
Wetting time: 125 seconds (1% solution), indicating a gentle surfactant level prioritizing conditioning over aggressive degreasing.
Note: The above values reflect the okra-forward herbal system; the decyl-glucoside prototype would typically display shorter wetting times and potentially higher foam volume at similar concentrations.

4.2 User Perception (n = 50)

- Effectiveness observed by people:
  - Highly effective: 30%
  - Moderately effective: 40%
  - Slightly effective: 20%
  - Not effective: 10%

- Feedback obtained: Increased softness, hair feels smoother, easier detangled, observed frizz reduction, pleasant fragrance. A group of people with very oily scalps preferred stronger cleansing and more foam.

5. Discussion

The okra-infused herbal shampoo successfully met the desired target which includes mild cleansing, increased moisturization and frizz reduction for dry, frizzy hair. Okra mucilage generally forms a thin, hydrating layer on the hair shaft which results in decreasing inter-hair shaft friction and improving cuticle health. This encourages detangling and reduces frizz without chemicals. Saponins from soap nut and shikakai, and by decyl glucoside, allow sufficient dirt removal at decreased risk of irritation compared to sulfates. Shear-thinning behavior improves user experience, The finished product is stable in the bottle. It spreads easily on hair, and rinses properly. Neutral to slightly acidic pH helps minimize cuticle swelling. Adjusting to pH 5.5–6.0 could further improve shine and control frizz.

Limitations:

- Preservation robustness: Preservative-efficacy testings (PET) are recommended for sodium benzoate as it is basically antifungal and pH-dependent preservative which may lead to chelation.
- Stability: Carry out some basic stability testings like accelerated and real-time stability testings on pH, viscosity, color, odor. Testing for packaging types is needed.
- Product performance: Comparing the results obtained from the formulated product (wet/dry combing forces, gloss, tensile strength/breakage, humidity-induced frizz area) with sulfate-free market products.
- Dosage improvement: Dosage of okra mucilage should be balanced for conditioning properties as well as clarity of the product. Explore natural co-thickeners and low-dose cationic surfactants if additional smoothness is required.

6. Conclusion

A herbal shampoo infused with okra mucilage and natural surfactants can provide effective cleansing with sufficient moisturization and frizz reduction in dry, frizzy hair which is tested and confirmed by physicochemical tests and positive user feedback. With proper preservation, stability confirmation, and precise instrumental standardization, okra mucilage stands out as a reliable, sustainable alternative to silicone and sulfate dominant conditioning shampoos.

8. References

1. Robbins, C. R. Chemical and Physical Behavior of Human Hair. 4th ed. Springer; 2002.
2. Gavazzoni Dias, M. F. R. Hair cosmetics: An overview. Int J Trichology. 2015;7:2–15.
3. Arora, P., Nanda, A., Karan, M. Shampoos based on synthetic vs. herbal ingredients: A review. Int J Pharm Sci Rev Res. 2011;7:41–46.
4. Zhang, Y., Alsop, R. J., Soomro, A., Yang, F. C., Rheinstädter, M. C. Effect of shampoo, conditioner and permanent waving on hair molecular structure. PeerJ. 2015;3:e1296.
5. Al Badi, K., Khan, S. A. Formulation, evaluation and comparison of an herbal shampoo with commercial shampoos. Beni-Suef Univ J Basic Appl Sci. 2014.
6. Vijayalakshmi, A., Sangeetha, S., Ranjith, N. Formulation and evaluation of herbal shampoo. Asian J Pharm Clin Res. 2018;11(4):121–124.

7. Fale, S. K., et al. Assessment and comparison of herbal and synthetic shampoos. J Pharmacogn Phytochem. 2020;9(5):3152–3155.
8. Ingale, A. S. Formulation and evaluation of herbal liquid shampoo. World J Pharm Res. 2020;9(5):901–911.
9. Akinyemi, B., Adepoju-Bello, A., Odeku, O. Formulation and evaluation of okra extract-containing low-foam shampoo. J Appl Pharm Sci. 2019;9(7):55–60.
10. Kochhar, S. I. Okra (lady's finger). In: Tropical Crops: A Textbook of Economic Botany. 1986:263–264.
11. Nilesh Jain. A review on Abelmoschus esculentus. Pharmacia. 2012;1:1–8.
12. D. Sathish Kumar et al. A review on Abelmoschus esculentus (Okra). Int Res J Pharm Appl Sci. 2013;3(4):129–130.
13. Revansiddappa, M., et al. Formulation and evaluation of herbal antidandruff shampoo. J Pharmacogn Phytochem. 2018;7(4):764–767.
14. Gaikwad, P. D. Formulation and evaluation of herbal shampoo. Int J Sci Res. 2018.
15. Ishii, M. K. Objective and instrumental methods for evaluation of hair-care efficacy. In: Hair and Hair Care. Marcel Dekker; 1997:261–302.
16. Draelos, Z. D., ed. Cosmetic Dermatology: Products and Procedures. Wiley-Blackwell; 2016.
17. Paus, R., Cotsarelis, G. The biology of hair follicles. N Engl J Med. 1999;341:491–498.
18. Stenn, K. S., Paus, R. Control of hair follicle cycling. Physiol Rev. 2001;81:449–494.
19. Hardy, M. H. The secret life of the hair follicle. Trends Genet. 1992;8:55–61.
20. Maurya, P., et al. A review article on herbal shampoo. JETIR. 2021.