

Formulation, Optimization and Evaluation of Polyherbal foot care roll on.

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Abstract: The present study focuses on the formulation and evaluation of herbal foot-care roll-on designed to address common foot ailments such as cracked heels, dryness, odor, and fungal infections using natural plant-based ingredients. Increasing awareness about the drawbacks of synthetic cosmetic products and growing consumer preference for eco-friendly, non-toxic alternatives have driven the exploration of herbal-based solutions. This project integrates therapeutic botanicals such as peppermint, aloe vera, neem, tea tree oil, lavender, and eucalyptus known for their antimicrobial, soothing, and moisturizing properties, into a convenient, hygienic roll-on applicator. The formulation was developed, optimized, and evaluated across multiple parameters including pH, viscosity, spreadability, skin compatibility, and user acceptance. Ten batch variations were tested, with several showing excellent performance in terms of texture, stability, and acceptance. The results validate the roll-on as a multifunctional herbal product that supports both personal hygiene and dermatological wellness, promoting healing while enhancing user convenience and safety.

Keywords: Herbal foot-care, Roll-on formulation, Crack heels, Plant-based ingredients, Skin compatibility, Natural cosmetics, Personal hygiene.

Introduction: People often neglect their feet, even though healthy feet are essential for staying active and comfortable in daily life. The constant pressure from walking, long hours of standing, or wearing tight shoes can cause a range of problems—from dry, cracked heels and thickened skin to fungal infections and pain in the joints or lower back due to poor alignment. Taking simple steps like washing feet regularly, keeping them moisturized, and using specific treatments when needed can go a long way in avoiding these issues. It's especially important for individuals with diabetes or circulation disorders, as early signs of serious conditions often appear in the feet [1].

With more people becoming aware of the potential risks linked to synthetic chemicals, there's a growing preference for herbal cosmetics that are safer, more natural, and environmentally friendly. When it comes to foot care, roll-on applicators have become a practical choice. They're easy to use, hygienic, and allow for precise application. Due to their ball-tip design, the product stays protected inside, reducing the chance of contamination. It also makes it easier to apply just the right amount to specific problem areas like cracked heels, fungal spots, or pressure points without getting your hands messy or wasting any product.

Materials and Methods: The present study was conducted to evaluate the effectiveness of a herbal foot-care formulation. All materials used were sourced from certified suppliers. Table 1 list various ingredients used for formulation and also there therapeutic properties are enlisted.

Table 1: List of various ingredients and their therapeutic properties used for formulation of herbal foot roll on.

Ingredient	Botanical Name	Key Therapeutic Properties
Aloe Vera	<i>Aloe barbadensis miller</i>	Soothing, wound-healing, hydrating [2]
Neem	<i>Azadirachta indica</i>	Antimicrobial, anti-inflammatory, detoxifying [3]
Peppermint	<i>Mentha piperita</i>	Cooling analgesic, antimicrobial, circulation booster [4]
Tea Tree Oil	<i>Melaleuca alternifolia</i>	Broad-spectrum antimicrobial/antifungal, antiseptic [6]
Lavender	<i>Lavandula angustifolia</i>	Calming, antiseptic, anti-inflammatory [7]
Eucalyptus	<i>Eucalyptus globulus</i>	Refreshing, antimicrobial, mild decongestant [8]

Preformulation Studies: Preformulation involves the investigation of the medicinal substance's physical and chemical properties, both in isolation and in conjunction with excipients. This is the first step towards developing dosage forms that are appropriate. The colour, flavour, and odour of the ingredients were all analysed.

Formulations of herbal foot roll on: The roll-on formulation was prepared following thorough cleaning of all glassware and precise weighing of each ingredient. The comprehensive formulation table for herbal foot care roll-on, consolidating all variants (F1–

F10) into a single structured table 2. Shea butter and beeswax were melted together at 40–45 °C to form a uniform mixture. The carrier oil phase was prepared by gently heating coconut oil, after which the previously melted mixture of beeswax and shea butter was added to it with continuous stirring. Once the oil phase became uniform, the pre-measured herbal extracts were incorporated carefully, ensuring that the temperature remained controlled to avoid degradation of heat-sensitive active compounds. Using a micropipette, the essential oils were added to the mixture, followed by gentle stirring to ensure uniform distribution throughout the formulation. Lecithin was added to the formulation as a solubilizer and antioxidant [9], while sodium benzoate was incorporated as a preservative [10]. The entire blend was transferred to a homogenizer for uniform mixing. The formulation was then allowed to cool gradually to room temperature with gentle stirring to prevent any phase separation. The cooled formulation was filled into pre-cleaned, pre-sterilized roll-on bottles using aseptic techniques to ensure product hygiene and safety.

Table 2: Formulation of herbal roll on

Ingredients	Batches									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Carrier Oils (Total: 24 g)										
Fractionated Coconut Oil	25.0	28.0	28.0	28.0	20.0	25.0	25.0	25.0	25.0	25.0
Butters & Waxes (Total: 2.4 g)										
Shea Butter (or Cocoa Butter)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Beeswax	0.9	0.9	0.9	0.6	0.9	0.9	0.9	0.9	0.9	0.9
Herbal Extracts (Total: 1.2g)										
Aloe Vera	0.90	0.90	0.99	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Neem	0.30	0.30	0.33	0.30	0.30	0.30	0.45	0.30	0.30	0.30
Essential Oils (Total: 0.30 g)										
Peppermint Oil	0.12	0.16	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Tea Tree Oil	0.06	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Lavender Oil	0.06	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Eucalyptus Oil	0.06	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Additional Excipients (Total: 0.57 g)										
Lecithin	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.20	0.15	0.15
Vitamin E	0.15	0.15	0.15	0.15	0.15	0.20	0.15	0.15	0.15	0.15
Sodium Benzoate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Propylene glycol	2	3	3	3	3	3	2.5	2.5	2.5	3
Total (mg)	31.23	35.33	35.35	34.93	27.23	32.28	31.88	31.78	31.73	30.73

Result and Discussion: The main objectives of this project work were to formulate and evaluate the herbal foot roll on using natural ingredients as effective foot care product. We had optimise the F8 formulation and evaluated for various properties. The findings of a multi-parameter evaluation of herbal foot roll on are shown in Table 3. All formulations displayed a smooth and uniform consistency, with no evidence of phase separation, indicating effective blending of carrier oils, butters, waxes, and herbal actives. The formulation exhibited a pale yellow color (figure 1) and a minty-fresh odor . The pH values of all samples ranged between 5 and 6, falling within the ideal skin-compatible range [11] and thereby minimizing the risk of irritation. The average Viscosity value was 1437.0 cp and spreadability 26.5 g·cm/sec. No signs of redness, swelling, burning, or itching were observed during the patch test.

Table 3: Evaluation of trial formulation batches

Formulation Code	pH	Viscosity (cp)	Spreadability (g·cm/sec)
F1	5.2±0.08	1230±55	25
F2	6.0±0.02	1102±45	30
F3	5.8±0.06	1000±35	22
F4	5.9±0.03	1009±75	28
F5	6.1±0.04	1500±61	26
F6	6.1±0.04	1750±32	30
F7	6.0±0.09	1680±55	20
F8	5.9±0.01	1865± 20	25
F9	6.0±0.04	1875±85	29
F10	5.4±0.07	1360±65	30

Conclusion: The experimental findings collectively indicate that the herbal foot care roll-on formulations effectively achieve a balance between aesthetic appeal, functional performance, and skin compatibility. These formulations not only protect the feet from microbial contamination but also aid in the healing of minor skin abrasions and cracked heels, thereby offering substantial therapeutic benefits. Further clinical studies and extended stability evaluation are recommended to support future commercialization.

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