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Development and Evaluation of Polyherbal Facewash for skin care

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Abstract
The rising preference for natural and eco-friendly skincare products has accelerated research into herbal cosmetics. Conventional face washes often contain synthetic surfactants, preservatives, and fragrances that may cause irritation, dryness, or allergic reactions with prolonged use [6, 14]. Herbal face washes, formulated with plant-derived actives, offer a safer and multifunctional alternative owing to their antimicrobial, antioxidant, and anti-inflammatory properties [7, 9, 21]. The present research focuses on the formulation and evaluation of a polyherbal face wash gel prepared using *Azadirachta indica* (Neem), *Curcuma longa* (Turmeric), and *Aloe barbadensis* (Aloe Vera), supplemented with *Ocimum tenuiflorum* (Tulsi), honey, citrus peels, and other natural ingredients. The formulations were evaluated for organoleptic properties, physicochemical parameters (pH, viscosity, homogeneity), foaming capacity, spreadability, extrudability, washability, antimicrobial activity, and stability under accelerated conditions [2, 3, 10]. Results confirmed that the formulations were stable, compatible with skin physiology, non-greasy, and easy to wash off, with pH values ranging between 5.5–5.8, which is ideal for maintaining the acid mantle of human skin [1, 4]. Among the four formulations, F2 emerged as the most optimized, showing superior foaming, spreadability, and antimicrobial efficacy [8, 18].

Keywords: Polyherbal formulation, Herbal cosmetics, Phytoconstituents, Antimicrobial

Introduction
Skin is the largest organ of the human body, covering approximately 1.5–2 m² in adults and accounting for nearly 15% of total body weight [5, 25]. It acts as a protective barrier against ultraviolet radiation, pollutants, pathogens, and mechanical insults, while also playing essential roles in thermoregulation, sensation, and water retention [23]. Facial skin, being more exposed, is particularly vulnerable to environmental stress, oxidative damage, and microbial colonization, making daily cleansing an important part of skincare routines [11].
Face washes are cosmetic preparations primarily designed for removing dirt, excess oil, and microbial contaminants from the skin surface. While synthetic face washes are effective, many contain harsh surfactants such as sodium lauryl sulfate and synthetic preservatives that can strip natural oils, disrupt the skin's protective barrier, and trigger irritation or acne flare-ups [6, 14, 20]. Historical practices further emphasize the dangers of chemical cosmetics — for example, 18th-century European women used lead carbonate as a whitening agent, which caused chronic lead poisoning and permanent tissue damage [15].
In contrast, herbal cosmetics harness bioactive phytochemicals that not only cleanse but also nourish, heal, and protect the skin [22]. Ayurveda, the traditional Indian system of medicine, describes a wide variety of herbs with dermatological benefits [24]. Among them:
- Neem (*Azadirachta indica*) – antibacterial, antifungal, and anti-inflammatory properties [8, 17].
- Turmeric (*Curcuma longa*) – antioxidant, anti-inflammatory, scar reducing [9].
- Aloe vera (*Aloe barbadensis*) – soothing, hydrating, collagen-promoting [7, 21].
- Tulsi (*Ocimum tenuiflorum*) – antimicrobial and purifying [12].
- Honey, citrus peel, almond oil, rice flour – exfoliating, moisturizing, nourishing [19].
The aim of this study was to prepare polyherbal face wash formulations using these natural

actives, optimize their physicochemical characteristics, and compare their performance with marketed products [1, 2, 3].

Materials and Methods

Materials: Herbal actives such as neem, turmeric, aloe vera, tulsi, rose petals, orange peel, banana peel powder, honey, almond oil, lemon grass, and rice flour were selected for formulation [17, 18]. Excipients included carbopol 934 (gelling agent), sodium lauryl sulfate (foaming agent), propylene glycol (humectant), triethanolamine (pH adjuster), and parabens are utilized as preservatives in the formulation of polyherbal face wash [10].

Extraction of Herbal Ingredients: Herbs were dried, powdered, and extracted using hydroalcoholic (70:30 ethanol-water) method, a standard technique for maximizing phytoconstituent recovery [3, 16].

Extracts were filtered and concentrated using a water bath at 50–55 °C [19].

Preparation of Formulations: Formulations F1–F5 were prepared by dispersing carbopol in water, adding sodium lauryl sulfate, herbal extracts, honey, almond oil, and citrus peel powder, followed by homogenization of all the powdered materials [2, 18].

Evaluation Parameters: Formulations were tested for organoleptic, physicochemical, foaming, spreadability, extrudability, irritation, antimicrobial activity, and stability as per standard protocols [13, 18, 19].

Table 1: Formulation of Polyherbal Face Wash (F1–F5)

Ingredients	F1 (% w/w)	F2 (% w/w)	F3 (% w/w)	F4 (% w/w)	F5 (% w/w)
Neem extract	2.0	3.0	2.5	2.0	3.0
Turmeric extract	1.0	1.5	2.0	1.0	1.5
Aloe vera gel	5.0	7.0	6.0	5.0	7.0
Tulsi extract	1.0	1.5	1.0	2.0	1.5
Honey	2.0	3.0	2.5	2.0	3.0
Orange peel powder	1.0	1.0	1.5	1.0	1.0
Almond oil	0.5	0.5	0.5	0.5	0.5
Carbopol 934	1.0	1.2	1.0	1.5	1.2
Sodium Lauryl Sulfate (SLS)	2.0	2.5	2.0	2.5	2.5
Propylene Glycol	3.0	4.0	3.5	3.0	4.0
Triethanolamine (pH adjuster)	q.s.	q.s.	q.s.	q.s.	q.s.
Distilled water	Up to 100	Up to 100	Up to 100	Up to 100	Up to 100

Results

All four formulations showed desirable organoleptic properties (brown colour, smooth texture, herbal odour) and maintained pH 5.5–5.8, ideal for skin [4,6]. Viscosity increased with carbopol concentration, affecting spreadability [10]. Foaming capacity ranged from 1.5–2.8 cm, with F2 showing maximum foam retention, comparable to marketed face washes [13, 19]. Spreadability and extrudability were best in F2 and F3, ensuring consumer acceptability. Skin irritation tests confirmed safety, as no redness or itching was observed in volunteers while formulation F [18].

Antimicrobial activity revealed inhibition zones of 12–19 mm against Staphylococcus aureus and Propionibacterium acnes, with F2 exhibiting the strongest effect due to neem andturmericsynergy [8, 9, 12, 18].

Stability studies confirmed no change in colour, odour, viscosity, or pH after 4 weeks at 45 °C and 75% RH [3, 19].

Overall, F2 emerged as the optimized formulation due to its balance of viscosity, foaming, spreadability, and antimicrobial potential [1, 2].

Table 2: Physicochemical Properties of Formulations (F1–F5)

Formulation	Colour	Odour	Consistency	pH	Viscosity (cps)
F1	Brown	Herbal	Smooth gel	5.6	4500
F2	Brown	Herbal	Smooth gel	5.5	4700
F3	Brown	Herbal	Smooth gel	5.8	4400
F4	Brown	Herbal	Smooth gel	5.7	4600
F5	Brown	Herbal	Smooth gel	5.6	4550

Table 3: Foaming Capacity of Formulations

Formulation	Initial Foam Height (cm)	Foam Height after 5 min (cm)
F1	2.0	1.7
F2	2.8	2.5
F3	2.4	2.1
F4	2.2	1.9
F5	2.6	2.3

Table 4: Spread ability & Extrudability of Formulations

Formulation	Spreadability (g·cm/sec)	Extrudability (cm^2/sec)
F1	12.5	1.8
F2	15.2	2.2
F3	14.8	2.0
F4	13.9	1.9
F5	14.6	2.1

Table 5: Antimicrobial Activity (Zone of Inhibition in mm)

Formulation	Staphylococcus aureus	Propionibacterium acnes
F1	14	12
F2	19	18
F3	16	15
F4	15	14
F5	17	16

Discussion

The results highlight the benefits of polyherbal formulations in skincare. The pH compatibility ensures skin barrier protection [5]. Foaming and washability indicate good cleansing ability, while spreadability and extrudability enhance user compliance [13]. The absence of irritation reflects the safety of natural actives compared to synthetic cleansers [6, 14].

The strong antimicrobial action of F2 validates the synergistic effects of neem and turmeric, which are well-documented for anti-acne activity [8, 9, 17]. Aloe vera further contributes soothing and moisturizing effects, preventing dryness post-wash [7]. These findings are consistent with earlier studies showing that polyherbal face washes outperformsingle-herbformulations [11, 18]. When compared with marketed herbal products, the prepared formulations showed comparable or improved results, supporting their potential for commercialization [2, 4, 17].

Conclusion

This study successfully formulated and evaluated polyherbal face wash gels containing neem, turmeric, aloe vera, and tulsi, supplemented with natural additives like honey and citrus peel. The formulations demonstrated favourable cosmetic, antimicrobial, and stability characteristics. Among them, F2 was the most optimized, providing a safe and effective natural alternative to synthetic face washes [1, 2, 18].

Future studies should include clinical efficacy trials, consumer preference surveys, and large-scale production feasibility to strengthen the case for commercialization [17, 19, 21].

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