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Research Article

# FORMULATION AND EVALUATION OF POLYHERBAL FACE PACK FOR TOPICAL SKINCARE APPLICATION

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**Abstract**

The increasing demand for natural skincare products has accelerated the development of herbal cosmetic formulations that offer improved dermatological compatibility, reduced adverse effects, and multifunctional therapeutic benefits. The present study aimed to formulate and evaluate a polyherbal face pack using selected Indian medicinal plants for topical skincare application. The formulation incorporated aloe vera (Aloe vera), red sandalwood (Pterocarpus santalinus), hibiscus (Hibiscus rosa-sinensis), ashwagandha (Withania somnifera), neem (Azadirachta indica), and turmeric (Curcuma longa) in powder form, selected based on their documented anti-inflammatory, antimicrobial, antioxidant, anti-aging, detoxifying, and skin-protective properties. The herbal face pack was prepared using the dry powder blending method involving drying, pulverization, sieving, geometric mixing, blending, and storage under controlled conditions. The prepared formulation was evaluated for organoleptic properties, powder flow characteristics, skin irritation, and physical stability. The developed face pack demonstrated acceptable cosmetic properties including yellowish appearance, fine powder texture, smooth consistency, and favorable handling characteristics. Bulk density and tapped density were found to be 0.66 g/mL and 0.833 g/mL, respectively, while particle size was reported as 24.3 µm. Skin irritation testing demonstrated no redness, itching, or adverse dermatological response. Stability studies revealed no significant changes in color, odor, or texture during the study period. The findings suggest that the developed polyherbal face pack may serve as a safe, economical, and cosmetically acceptable herbal skincare formulation.

Keywords: Herbal face pack, polyherbal cosmetics, topical skincare, aloe vera, neem, turmeric, red sandalwood, hibiscus, ashwagandha

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## Introduction

Skin is the largest organ of the human body and serves as a complex multifunctional protective barrier against environmental insults including microbial pathogens, ultraviolet radiation, pollutants, allergens, and chemical irritants (3). In addition to its protective role, the skin contributes to immune surveillance, thermoregulation, sensory function, hydration maintenance, and metabolic processes essential for physiological homeostasis.

Modern lifestyle factors including stress, pollution exposure, ultraviolet radiation, poor nutrition, irregular sleep patterns, and environmental contamination contribute significantly to dermatological concerns such as acne, pigmentation, dryness, premature aging, dullness, inflammation, and oxidative skin damage (4). As a result, skincare formulations have become increasingly important not only for cosmetic enhancement but also for maintaining skin health and protective function.

Among topical cosmetic preparations, face packs remain widely used for cleansing, exfoliation, nourishment, pore purification, sebum control, and aesthetic skin improvement. Traditional herbal face packs have long been used in Ayurvedic and natural skincare systems due to their ability to provide multiple dermatological benefits with relatively lower risk of adverse effects compared with synthetic formulations (5).

Growing awareness regarding the limitations of synthetic cosmetic ingredients has increased demand for plant-based alternatives. Conventional cosmetic products may contain harsh chemical agents capable of causing irritation, allergic reactions, barrier disruption, and cumulative dermatological sensitivity (2). Herbal cosmetics are increasingly favored because they integrate therapeutic phytochemicals with cosmetic functionality while often demonstrating improved tolerability and environmental sustainability (6).

The present formulation incorporates several medicinal plants selected for complementary skincare benefits. Aloe vera (*Aloe vera*) is widely recognized for its moisturizing, anti-inflammatory, wound-healing, antimicrobial, and soothing properties due to its rich content of polysaccharides, amino acids, vitamins, enzymes, and anthraquinones (7). Red sandalwood (*Pterocarpus santalinus*) contributes anti-inflammatory, antioxidant, cooling, and antimicrobial properties beneficial for irritated and inflamed skin (8).

Hibiscus (*Hibiscus rosa-sinensis*) is rich in anthocyanins, flavonoids, vitamins, and antioxidants that support anti-aging effects, skin revitalization, and protection against oxidative stress (9). Ashwagandha (*Withania somnifera*) provides antioxidant, adaptogenic, anti-inflammatory, and rejuvenating effects that may support skin resilience and anti-aging benefits (10).

Neem (*Azadirachta indica*) remains one of the most extensively studied medicinal plants for dermatological applications due to its potent antimicrobial, antifungal, anti-inflammatory, antiseptic, and antioxidant activities mediated by compounds such as azadirachtin, nimbin, and nimbidin (11). Turmeric (*Curcuma longa*) contributes anti-inflammatory, antioxidant, antimicrobial, and wound-healing properties primarily through curcuminoids and essential oils (12).

The polyherbal combination used in the present study represents a rational multifunctional approach for skincare by integrating cleansing, anti-acne, antioxidant, anti-inflammatory, soothing, rejuvenating, and skin-protective effects into a single topical preparation.

The present study was therefore undertaken to formulate and evaluate a polyherbal herbal face pack for topical skincare application.

## Materials and Methods

The present investigation involved formulation and evaluation of a polyherbal face pack using medicinal plant powders selected for their dermatological and cosmetic properties. The herbal ingredients used in the formulation included aloe vera powder, red sandalwood powder, hibiscus powder, ashwagandha powder, neem powder, and turmeric powder.

Raw herbal materials were procured from reliable local sources and inspected for quality, purity, and absence of visible adulteration. Fresh plant materials, where applicable, were thoroughly washed to remove dust and extraneous contaminants. The materials were subjected to shade drying under controlled environmental conditions to preserve thermolabile phytoconstituents and reduce moisture content. Complete drying was ensured prior to further processing.

The dried herbal materials were separately pulverized using a mechanical grinder to obtain fine powders. The powdered materials were passed through standard sieves to achieve uniform particle size distribution and smooth cosmetic texture. Sieving was performed using sieve numbers specified in the thesis methodology to eliminate coarse particles and improve formulation consistency.

The final polyherbal face pack formulation was prepared according to the thesis composition for a total batch size of 30 g. The formulation consisted of aloe vera powder (5.2 g), red sandalwood powder (4.3 g), hibiscus powder (4.7 g), ashwagandha powder (6.4 g), neem powder (5.9 g), and turmeric powder (3.5 g).

All ingredients were accurately weighed using an analytical balance. Uniform mixing was performed using the geometric dilution method to ensure homogeneous distribution of active herbal components throughout the formulation. Additional blending was performed to achieve a free-flowing, smooth, and uniform cosmetic powder. The final formulation was transferred into airtight moisture-protective packaging and stored under dry conditions away from direct sunlight.

The prepared face pack was evaluated using standard cosmetic powder assessment methods. Organoleptic evaluation included visual and sensory assessment of color, appearance, texture, smoothness, and overall cosmetic acceptability. Powder flow and physical characterization included bulk density, tapped density, particle size determination, and flow behavior analysis.

Bulk density was determined by measuring the ratio of powder mass to untapped volume, while tapped density was determined following mechanical compaction according to standard powder evaluation methods. Particle size evaluation was performed according to the reported methodology, and powder flow properties were assessed using angle of repose principles.

Skin irritation testing was conducted through topical application of the prepared formulation on a small defined skin area followed by observation for erythema, itching, swelling, or visible dermatological reactions during the observation period.

Stability assessment involved storage of the prepared formulation under standard conditions with monitoring for physical changes including alteration in color, odor, texture, and overall physical acceptability.

**Results**

The formulated polyherbal face pack was successfully prepared and evaluated for physicochemical suitability, cosmetic acceptability, dermatological compatibility, and short-term physical stability. The developed formulation demonstrated favorable characteristics consistent with the intended application as a topical herbal skincare preparation.

Organoleptic evaluation revealed that the prepared face pack exhibited a **yellowish appearance**, attributable primarily to the incorporation of turmeric and other herbal constituents. The formulation was observed to be in **powder form** with a **fine texture** and satisfactory **smoothness**, indicating successful drying, pulverization, and blending of the selected herbal ingredients. The fine texture is particularly desirable for topical facial application because it facilitates uniform mixing with water or other vehicles prior to use and improves application comfort.

Physicochemical evaluation demonstrated a **bulk density of 0.66 g/mL** and a **tapped density of 0.833 g/mL**, indicating acceptable packing characteristics and moderate compressibility appropriate for powdered cosmetic formulations. The measured **particle size was 24.3 µm**, suggesting sufficiently fine powder distribution to support smooth topical application without excessive abrasiveness.

Powder flow assessment based on the reported angle of repose calculation suggested acceptable handling and flow behavior, supporting practical storage, packaging, and consumer usability. Although the thesis reported the tangent-derived value rather than the final angular value, the overall findings indicate acceptable flow-related characteristics.

Dermatological compatibility assessment demonstrated favorable tolerability. No visible **redness, itching, erythema, swelling, or irritation** was observed following topical application during the observation period, indicating acceptable short-term skin compatibility.

Stability observations demonstrated no significant physical changes in **color, odor, or texture** throughout the study period, suggesting acceptable short-term formulation stability under standard storage conditions.

Overall, the developed polyherbal face pack demonstrated satisfactory preliminary cosmetic and physicochemical performance.

**Discussion**

The present study successfully demonstrated the formulation and preliminary evaluation of a polyherbal face pack containing aloe vera, red sandalwood, hibiscus, ashwagandha, neem, and turmeric for topical skincare application. The findings support the increasing relevance of herbal cosmetic science in developing multifunctional plant-based skincare products that combine therapeutic phytochemical activity with cosmetic acceptability (1,2).

Face packs remain widely used in cosmetic dermatology because they provide multiple skincare benefits including cleansing, oil control, mild exfoliation, skin soothing, pore purification, and

aesthetic enhancement (5). Herbal formulations are particularly attractive because they incorporate naturally derived bioactive compounds with lower risk of adverse dermatological reactions compared with certain synthetic cosmetic ingredients (6).

The favorable organoleptic properties observed in the present study indicate good cosmetic acceptability. Consumer compliance with skincare products is strongly influenced by physical appearance, texture, ease of preparation, and comfort during application. The fine texture and smooth consistency observed in the present formulation suggest appropriate powder processing and ingredient compatibility.

Particle size is a particularly important parameter in topical powdered formulations. Fine particles enhance smoothness, improve skin adherence, reduce abrasive sensation, and support uniform application (13). The reported particle size of 24.3 µm indicates a suitably fine formulation likely to provide acceptable skin feel during practical use.

The bulk density and tapped density findings indicate acceptable powder packing and compressibility characteristics. These properties are relevant for manufacturing consistency, packaging efficiency, storage behavior, and formulation handling (14). Cosmetic powders with poor packing characteristics may exhibit caking, segregation, or inconsistent dosing behavior.

The absence of dermatological irritation is an encouraging finding, particularly for facial cosmetic formulations where skin sensitivity is a significant concern. The selected herbal ingredients provide a strong rationale for improved tolerability. Aloe vera contributes moisturizing, soothing, anti-inflammatory, and wound-healing effects that may reduce irritation potential (7). Red sandalwood offers cooling, anti-inflammatory, and antimicrobial activity beneficial for inflamed or acne-prone skin (8).

Hibiscus contributes antioxidant protection and anti-aging phytochemicals capable of reducing oxidative stress–mediated skin damage (9). Ashwagandha provides adaptogenic and antioxidant effects that may support skin resilience and anti-aging benefits (10). Neem contributes potent antimicrobial and anti-inflammatory properties, making it particularly useful in acne-prone or microbially challenged skin conditions (11). Turmeric strengthens the formulation through anti-inflammatory, antioxidant, antimicrobial, and complexion-enhancing properties attributed primarily to curcuminoids (12).

The synergistic combination of these medicinal plants likely contributes to the overall dermatological suitability of the formulation. Polyherbal cosmetic systems often provide broader multifunctional activity compared with single-herb formulations because of complementary phytochemical mechanisms.

The favorable stability findings are consistent with the inherent advantages of dry powder formulations. Compared with aqueous emulsions or semisolid preparations, powdered herbal formulations generally exhibit improved physicochemical stability due to lower water activity, reduced hydrolytic degradation, and decreased microbial proliferation risk (15). The absence of significant physical changes during the study supports acceptable short-term formulation integrity.

An additional practical advantage of the present formulation is economic accessibility. The use of readily available herbal ingredients and relatively simple manufacturing processes supports feasibility for low-cost cosmetic development.

Overall, the findings support the potential of the developed polyherbal face pack as a cosmetically acceptable herbal skincare product.

**Limitations of the Study**

Despite the encouraging findings of the present investigation, several limitations should be acknowledged. The study primarily involved preliminary formulation development and basic physicochemical evaluation without advanced analytical characterization such as phytochemical quantification, powder morphology analysis, moisture profiling, or instrumental skin compatibility assessment. Although the selected herbal ingredients possess documented pharmacological benefits, direct quantitative evaluation of antimicrobial, antioxidant, anti-inflammatory, anti-acne, or skin-brightening efficacy was not experimentally performed within the present study. The dermatological safety assessment was limited to short-term irritation observation and did not include controlled clinical testing involving larger human populations, which limits broader conclusions regarding long-term safety and real-world cosmetic performance. Stability testing was limited to short-term physical observations and did not include accelerated environmental stability assessment under controlled temperature and humidity stress conditions. Certain methodological reporting inconsistencies in the original thesis dataset, particularly regarding flow-property calculations, restrict precise interpretation of some powder parameters. Future investigations should incorporate advanced physicochemical characterization, microbiological efficacy studies, controlled dermatological trials, and extended stability validation to strengthen scientific credibility and support product development.

## Conclusion

The present study successfully formulated and evaluated a polyherbal face pack containing aloe vera, red sandalwood, hibiscus, ashwagandha, neem, and turmeric for topical skincare application. The developed formulation demonstrated acceptable cosmetic appearance, fine powder texture, satisfactory smoothness, favorable powder characteristics, acceptable dermatological compatibility, and short-term physical stability.

The selected medicinal plants provide a rational multifunctional herbal formulation strategy by integrating antioxidant, antimicrobial, anti-inflammatory, soothing, anti-aging, and skin-protective activities. The absence of irritation and favorable physical properties suggest that the formulation may be suitable as a natural skincare cosmetic preparation.

The findings support the growing role of herbal cosmetic formulations as safer and potentially effective alternatives to synthetic skincare products. Further advanced analytical validation, clinical efficacy assessment, and long-term stability studies are recommended to establish broader practical and commercial applicability.

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