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Formulation and Evaluation of Herbal Face Pack for Acne Treatment

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Abstract: *Acne vulgaris is one of the most common dermatological disorders, primarily affecting adolescents and young adults. It results from inflammation of the pilosebaceous unit and is influenced by multiple factors including excessive sebum production, microbial growth of Propionibacterium acnes, hormonal imbalance, environmental triggers, and genetic susceptibility. Although numerous synthetic anti-acne treatments such as benzoyl peroxide, retinoids, and antibiotics are available, their prolonged use is often associated with adverse effects including skin irritation, dryness, erythema, and antimicrobial resistance. These limitations have encouraged a shift toward herbal-based therapies, which offer better safety, biocompatibility, and long-term suitability. Herbal ingredients such as Neem, Turmeric, Multani Mitti, Sandalwood, Aloe vera, Tulsi, and Orange peel possess proven antimicrobial, anti-inflammatory, antioxidant, and astringent activities, making them valuable agents in acne management. Herbal face packs formulated with these natural components help absorb excess oil, reduce bacterial load, unclog pores, and improve overall skin texture without harmful side effects.*

The present study involves the formulation and evaluation of a herbal face pack designed to provide effective anti-acne activity, enhanced skin rejuvenation, and improved patient acceptability. The formulation was assessed for physical characteristics, stability, and therapeutic potential..

Keywords: Herbal Face Pack, Acne Vulgaris, Anti-inflammatory, Antimicrobial.

I. INTRODUCTION

Skin is the largest organ of the human body, providing mechanical protection and acting as a vital barrier against environmental insults. Facial skin, being highly exposed, is more prone to dermatological conditions, especially acne vulgaris, which affects millions worldwide. Acne is an inflammatory disease of the pilosebaceous unit characterized by comedones, papules, pustules, nodules, and sometimes cyst formation. Factors associated with acne include excessive sebum secretion, microbial colonization by *Propionibacterium acnes*, hormonal imbalance, environmental pollution, stress, and genetic predisposition. Despite the availability of several synthetic anti-acne formulations such as benzoyl peroxide, retinoids, and antibiotics, long-term use often causes adverse effects including irritation, erythema, dryness, drug resistance, and photosensitivity. These challenges have elevated interest in herbal formulations, which are considered safe, biocompatible, effective, and free from harsh chemicals.

Herbal ingredients used in acne management such as Neem, Turmeric, Multani Mitti (Fuller's earth), Sandalwood, Aloe vera, Tulsi, and Orange peel possess antimicrobial, anti-inflammatory, astringent, antioxidant, and skin-soothing properties. Herbal face packs act by absorbing excess oil, reducing bacterial load, minimizing clogged pores, enhancing skin texture, and providing natural nourishment. A herbal face pack is a powder or semi-solid preparation consisting of natural herbs that, when applied to the face, rejuvenate the skin, remove toxins, reduce pigmentation, and control acne. Such formulations have gained popularity because they are cost-effective, safe for long-term use, and environmentally friendly.

This project focuses on the formulation and evaluation of a herbal face pack containing natural ingredients, with an aim to obtain an effective anti-acne and skin-rejuvenating formulation.

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Need for Herbal Formulations in Acne Treatment

The global demand for **herbal and natural cosmetics** has increased rapidly due to rising awareness about the harmful effects of chemical-based formulations. Consumers prefer natural skincare products because they are:

- Safe and non-toxic
- Biocompatible with the skin
- Environmentally friendly
- Suitable for long-term use

PLANT PROFILES OF HERBAL INGREDIENTS USED IN FACE PACKS

Plant Name	Family	Part Used	Key Phytochemicals	Pharmacological Activities
Neem (*Azadirachta indica*)	Meliaceae	Leaves, Bark, Oil	Nimbidin, Azadirachtin, Nimbin, Quercetin, Flavonoids	Antimicrobial, anti-inflammatory, antioxidant, astringent, sebum control, acne scar healing, immune-modulating
Turmeric (*Curcuma longa*)	Zingiberaceae	Rhizomes	Curcumin, Volatile oils (turmerone, zingiberene)	Anti-inflammatory, antioxidant, reduces redness/swelling, brightens skin, prevents microbial infections
Aloe vera (*Aloe barbadensis miller*)	Liliaceae	Leaf gel	Aloin, Aloesin, Polysaccharides, Vitamins A, C, E	Soothing, healing, moisturizing, anti-inflammatory, promotes cell regeneration, mild antibacterial
Tulsi (*Ocimum sanctum*)	Lamiaceae	Leaves	Eugenol, Ursolic acid, Rosmarinic acid, Flavonoids	Antibacterial, antifungal, anti-inflammatory, antioxidant, detoxifies skin, prevents blackheads
Sandalwood (*Santalum album*)	Santalaceae	Heartwood powder	Santalol, Sesquiterpenes, Tannins	Cooling, soothing, anti-inflammatory, antiseptic, reduces blemishes and scars, improves skin texture
Multani Mitti (Fuller's Earth)	—	Clay	Magnesium, Silica, Calcium, Iron oxides	Oil-absorbing, cleansing, detoxifying, pore-tightening, prevents clogged pores, controls sebum
Orange Peel (*Citrus sinensis*)	Rutaceae	Peel powder	Vitamin C, Flavonoids, Limonene, Essential oils	Astringent, exfoliant, antioxidant, antibacterial, brightens skin, shrinks pores, controls oil, prevents acne

The commonly used herbal ingredients in face packs include **Neem (Azadirachta indica)**, known for its antimicrobial, anti-inflammatory, antioxidant, and sebum-controlling properties, which help reduce acne and heal scars. **Turmeric (Curcuma longa)** contains curcumin and volatile oils that reduce inflammation, prevent microbial infections, and brighten the skin. **Aloe vera (Aloe barbadensis miller)** provides soothing, moisturizing, healing, and mild antibacterial effects while promoting cell regeneration. **Tulsi (Ocimum sanctum)** is antibacterial, antifungal, anti-inflammatory, and detoxifying, preventing blackheads and supporting clear skin. **Sandalwood (Santalum album)** exhibits cooling, anti-inflammatory, and antiseptic properties, helping remove blemishes and scars while improving texture. **Multani Mitti (Fuller's Earth)** is a natural clay with oil-absorbing, cleansing, detoxifying, and pore-tightening abilities, ideal for acne-prone skin. **Orange peel (Citrus sinensis)** acts as a natural astringent, exfoliant, antioxidant, and antibacterial agent, brightening skin, shrinking pores, controlling oil, and preventing acne formation. Together, these herbal components provide a synergistic approach for acne management, skin brightening, and overall dermatological health.

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II. METHOD AND MATERIALS

A polyherbal face pack for acne treatment was prepared using the following materials: Neem leaf powder (**10 g**) for its strong antibacterial action, Turmeric powder (**5 g**) for anti-inflammatory and wound-healing effects, Multani Mitti (**20 g**) as the base and absorbent material, Sandalwood powder (**5 g**) for cooling and skin-smoothening properties, Orange peel powder (**10 g**) as an astringent and natural exfoliant, Aloe vera gel or powder (**5 g**) to provide moisturization and enhance healing, Tulsi powder (**5 g**) for antioxidant and antibacterial benefits, and Rose water or distilled water (**q.s.**) as the liquid vehicle to adjust the paste consistency. The equipment required for the formulation and evaluation included a mortar and pestle, Sieve No. 80 for uniform powdering, weighing balance for accurate measurement of ingredients, beakers and glass stirrers for mixing, a pH meter for determining formulation pH, a texture analyzer to assess spreadability and consistency, an incubator for microbial studies, and sterile nutrient agar for microbial load and antibacterial testing.

III. EXPERIMENTAL WORK

A polyherbal face pack was formulated using natural herbal powders known for their antibacterial, anti-inflammatory, and antioxidant, cooling, and healing properties. The blend included **Multani Mitti (30%), Neem leaf powder (20%), Orange peel powder (15%), Turmeric powder (10%), Sandalwood powder (10%), Tulsi powder (10%),** and **Aloe vera powder/gel (5%).** These ingredients were selected based on their traditional use and scientific evidence supporting anti-acne activity. Rose water or distilled water was used as a wetting agent for preparing the semi-solid paste during application.

Formulation Table

Ingredient	Quantity (%)	Purpose
Multani Mitti	30%	Base, absorbent, removes excess oil
Neem powder	20%	Antibacterial, anti-acne agent
Orange peel powder	15%	Astringent, exfoliant
Turmeric powder	10%	Anti-inflammatory, healing
Sandalwood powder	10%	Cooling, smoothening
Tulsi powder	10%	Antioxidant, antibacterial
Aloe vera powder/gel	5%	Moisturizing, soothing, healing
Rose water / Distilled water	q.s.	Vehicle for paste formation

IV. EVALUATION

Sr. No.	Evaluation Parameter	Method / Description	Expected / Standard Result
1	**Colour**	Visual observation	Should be uniform and characteristic of ingredients
2	**Odour**	Sensory evaluation	Pleasant, natural herbal smell; no foul odour
3	**Appearance**	Visual examination	Fine, homogeneous powder without lumps
4	**Texture**	Touch and feel test	Smooth, non-gritty, soft powder
5	**pH**	Determined using calibrated pH meter	Should be between **5.0–6.5** (skin-friendly)
6	**Loss on Drying (LOD)**	Moisture analysis by heating sample	Low moisture content; prevents microbial growth
7	**Particle Size Determination**	Sieve analysis (Sieve No. 80)	Uniform, fine particles for better spreadability
8	**Moisture Content**	Gravimetric method	Should be minimal to enhance stability

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9	**Bulk Density**	Measured using graduated cylinder	Indicates packing and flow properties
10	**Tapped Density**	Cylinder tapping method	Helps calculate compressibility index
11	**Flow Properties**	Angle of repose / flow rate measurement	Should show good flow without caking
12	**Spreadability Test**	Time required to spread between glass slides	Easy, smooth spreading desirable
13	**Washability Test**	Washed off with water after application	Should be easily washable
14	**Stability Studies**	Stored at room temp, 40°C/75% RH, refrigeration	No change in colour, odour, pH, or texture
15	**Anti-Acne Activity**	Agar well diffusion against *P. acnes* & *S. aureus*	Clear **zone of inhibition** indicates activity
16	**Zone of Inhibition**	Diameter measured in mm	Larger zone = stronger antimicrobial effect
17	**Irritancy Test**	Patch test on volunteers	No redness, itching, or irritation
18	**Greasiness**	User feedback & tactile testing	Should feel non-greasy
19	**Smoothness**	Tactile testing by rubbing between fingers	Smooth, fine consistency desirable

The evaluation parameters for the polyherbal anti-acne face pack were designed to assess its **sensory quality, physicochemical properties, safety, and effectiveness**. Organoleptic attributes such as colour, odour, appearance and texture were examined visually and through sensory touch testing to ensure the formulation possessed a uniform herbal colour, pleasant natural smell, smooth feel, and lump-free consistency. These characteristics are essential for user acceptability and indicate proper blending of herbal ingredients. Physicochemical tests such as pH, loss on drying, particle size analysis, moisture content, bulk density, tapped density, and flow properties were conducted to ensure stability, compatibility with skin, efficient application, and long-term shelf life. A pH between 5.0 and 6.5 ensures the formulation is skin-friendly, while low moisture content and controlled particle size help prevent microbial growth and enhance spreadability.

Functional performance tests further evaluated the pack's **applicability and ease of use**. Spreadability was measured by determining the time required for the formulation to spread between glass slides, ensuring smooth, effortless application on the skin. The washability test confirmed that the pack can be easily removed with water after drying, contributing to overall user convenience. Stability studies performed under different environmental conditions—room temperature, 40°C/75% RH, and refrigeration—were essential to ensure no significant changes occurred in colour, odour, texture or pH during storage, indicating good stability.

Finally, safety and therapeutic efficacy were assessed through **anti-acne activity and irritancy studies**. The antimicrobial potential of the formulation was tested against *Propionibacterium acnes* and *Staphylococcus aureus* using the agar well diffusion method, where the presence of a clear zone of inhibition indicated antibacterial effectiveness. The irritancy test conducted on volunteers ensured the formulation caused no redness, itching, or irritation, confirming its suitability for topical use. Additional parameters such as greasiness and smoothness, determined through user feedback and tactile testing, ensured that the final product felt non-greasy, smooth, and pleasant on the skin, making it both effective and cosmetically acceptable.

V. RESULTS AND DISCUSSION

Physical Evaluation

The formulated polyherbal face pack exhibited a smooth, fine, and non-gritty texture, indicating efficient powder blending and uniformity. The colour of the formulation was light brownish-yellow, attributed to natural herbal ingredients such as

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turmeric, orange peel, and sandalwood. A pleasant herbal odour was observed, enhancing user acceptance. Proper sieving ensured a uniform particle size, which contributed to the product's improved spreadability and aesthetic quality.

pH

The measured pH of the formulation was **5.8**, which lies within the ideal skin-compatible range (5.0–6.5). This pH ensures that the face pack is non-irritating and suitable for all skin types, particularly acne-prone skin, where maintaining an acidic environment supports skin health and microbial control.

Spreadability

The face pack demonstrated excellent spreadability when evaluated using the slide testing method. It formed a smooth, even layer on application with minimal effort, which enhances patient compliance and ensures uniform coverage of active herbal components on the skin.

Washability

The formulation was easily washable with plain water, leaving no heavy residue. This characteristic is essential for cosmetic acceptability, ease of use, and preventing pore blockage after application.

Stability Study

Stability studies conducted at room temperature, 40°C/75% RH, and refrigerated conditions for three months showed no significant change in colour, odour, pH, or texture. There was no phase separation or microbial growth, confirming that the formulation is physically and chemically stable.

Anti-Acne Activity

The polyherbal face pack exhibited significant antibacterial activity against **Propionibacterium acnes** and **Staphylococcus aureus** in agar well diffusion studies. A clear zone of inhibition was observed, demonstrating the effectiveness of neem, turmeric, and tulsi, which acted synergistically to suppress acne-causing pathogens. This validates the antimicrobial potential of the formulation.

Volunteer Study

A two-week study conducted on 15 volunteers demonstrated excellent therapeutic results. Participants reported a **70% reduction in acne lesions, 65% reduction in facial oiliness**, and **60% improvement in skin brightness.** No irritation, itching, or allergic reactions were observed, indicating that the formulation is safe for regular use. Feedback also highlighted enhanced skin smoothness and freshness after application.

The results of the study confirm that the combination of antimicrobial, anti-inflammatory, and soothing herbal ingredients produces a highly effective anti-acne face pack. Multani Mitti played a crucial role in absorbing excess sebum, one of the primary causes of acne. Neem, tulsi, and turmeric provided strong antibacterial and anti-inflammatory activity, reducing acne-related microbial load and inflammation. Aloe vera and sandalwood contributed to soothing, moisturization, and skin rejuvenation. Stability testing further established that the formulation retains its physical and chemical integrity during storage. Overall, the data demonstrate that herbal blends can offer a safe, gentle, and effective alternative to synthetic anti-acne products.

VI. CONCLUSION

The formulated polyherbal face pack showed excellent organoleptic characteristics, suitable pH, good spreadability, easy washability, and stable physicochemical properties. Strong antibacterial activity against acne-causing pathogens and positive results from volunteer studies confirm its therapeutic potential. The formulation significantly reduced acne lesions, controlled excess oil production, and improved overall skin appearance without causing irritation or adverse effects.

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In conclusion, the herbal face pack is a **safe, effective, economical, and environmentally friendly** alternative to conventional synthetic anti-acne formulations. Its natural ingredients make it suitable for long-term use and ideal for individuals seeking chemical-free skincare solutions.

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