Formulation and Evaluation of Herbal Scrub Powder

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Abstract

The increasing awareness of the adverse effects of synthetic cosmetic formulations has propelled the demand for herbal-based skincare products. In the present study, a herbal scrub powder was developed using plant-derived ingredients with proven therapeutic and dermatological benefits. The formulation was designed to provide effective exfoliation, sebum regulation, antibacterial action, and anti-inflammatory activity.

The powder was prepared via a dry blending process incorporating Citrus sinensis (orange peel), Azadirachta indica (neem), Ocimum sanctum (tulsi), Curcuma longa (turmeric), Rosa indica (rose petals), Fuller's earth (multani mitti), and Cicer arietinum (gram flour). Physicochemical parameters including organoleptic characteristics, bulk density, tapped density, angle of repose, Carr's index, Hausner's ratio, moisture content, pH, grittiness, and microbial load were evaluated.

Stability studies were conducted as per ICH guidelines at 25°C/60% RH and 40°C/75% RH[(1)]. The formulation exhibited excellent flow properties, low moisture content, acceptable grittiness, and no microbial growth, confirming its suitability as a safe, effective, and shelf-stable herbal cosmetic.

Keywords: Herbal scrub, Polyherbal formulation, Exfoliation, Anti-acne, Cosmeceuticals, Flow properties, Stability studies, Neem, Turmeric

INTRODUCTION-

Skin exfoliation is a vital step in maintaining epidermal homeostasis. Over time, the accumulation of corneocytes, sebum, and environmental pollutants results in clogged pores and dull complexion. Conventional exfoliating agents often contain **plastic microbeads, parabens, or alcohol-based astringents**, which may disrupt the stratum corneum integrity.

In contrast, **herbal-based scrub formulations** offer gentle cleansing, are environmentally friendly, and present a **lower risk of allergic or irritant contact dermatitis**. Herbs such as Azadirachta indica and Curcuma longa are well-documented for their **anti-inflammatory, antimicrobial, and wound-healing** actions.

This project aims to create a scientifically sound, pharmacognostically validated, **topical polyherbal exfoliant**, and to standardize its physical properties and stability profile.[(2)]

Rationale:

- Increasing preference for clean-label, natural cosmetics.
- Microbeads ban in many countries due to environmental damage.
- Demand for dermatologically safe and multifunctional cosmetic formulations.

Pharmacognosy of Active Ingredients

1. Neem (Azadirachta indica A. Juss.)

Fig. no.1 Neem

- **Taxonomy:**
  - Kingdom: Plantae
  - Order: Sapindales
  - Family: Meliaceae
  - Genus: Azadirachta
  - Species: Azadirachta indica
  - Synonym: Melia azadirachta
- **Common names:** Neem, Indian lilac, Margosa tree
- **Parts used:** Leaves
- **Key constituents:** Nimbin, Nimbidin, Azadirachtin, Quercetin, Salannin
- **Therapeutic uses:** Antimicrobial, anti-inflammatory, insecticidal, skin cleanser
- **Relevance in scrub:** Reduces acne-causing bacteria and skin inflammation

2. Turmeric (Curcuma longa Linn.)

Fig. no.2Turmeric

- **Taxonomy:**
  - Kingdom: Plantae
  - Order: Zingiberales
  - Family: Zingiberaceae
  - Genus: Curcuma
  - Species: Curcuma longa

- Synonym: Curcuma domestica
- **Common names:** Turmeric, Haldi, Haridra
- **Parts used:** Rhizome
- **Key constituents:** Curcuminoids (Curcumin, Demethoxycurcumin), Volatile oils (Turmerone)
- **Therapeutic uses:** Antioxidant, anti-inflammatory, wound healing, skin brightening
- **Relevance in scrub:** Evens skin tone, reduces pigmentation and inflammation

3. Tulsi (Ocimum sanctum Linn.)

Fig. no.3 Tulsi

- **Taxonomy:**
  - Kingdom: Plantae
  - Order: Lamiales
  - Family: Lamiaceae
  - Genus: Ocimum
  - Species: Ocimum sanctum
  - Synonym: Ocimum tenuiflorum
- **Common names:** Holy Basil, Tulsi, Sacred Basil
- **Parts used:** Leaves
- **Key constituents:** Eugenol, Ursolic acid, Rosmarinic acid, Linalool
- **Therapeutic uses:** Adaptogen, antimicrobial, antioxidant
- **Relevance in scrub:** Protects skin from infections and detoxifies pores

4. Orange Peel (Citrus sinensis Linn.)

Fig. no.4 Orange Peel

- **Taxonomy:**
  - Kingdom: Plantae
  - Order: Sapindales
  - Family: Rutaceae
  - Genus: Citrus
  - Species: Citrus sinensis
  - Synonym: Citrus aurantium var. sinensis

- **Common names:** Sweet orange, Santra, Narangi
- **Parts used:** Dried peel
- **Key constituents:** Limonene, Hesperidin, Naringin, Ascorbic acid
- **Therapeutic uses:** Skin lightening, antioxidant, astringent
- **Relevance in scrub:** Natural exfoliator, removes dead skin and tightens pores

5. Rose Petals (Rosa indica Linn.)

Fig. no. 5 Rose Petals

- **Taxonomy:**
  - Kingdom: Plantae
  - Order: Rosales
  - Family: Rosaceae
  - Genus: Rosa
  - Species: Rosa indica
  - Synonym: Rosa centifolia (in some texts)
- **Common names:** Rose, Gulab
- **Parts used:** Petals
- **Key constituents:** Anthocyanins, Citronellol, Geraniol, Flavonoids
- **Therapeutic uses:** Anti-inflammatory, cooling, soothing, aromatic
- **Relevance in scrub:** Soothes the skin, reduces irritation, adds pleasant fragrance

6. Multani Mitti (Fuller's Earth)

Fig. no.6 Multani Mitti

- **Taxonomy (Mineral origin):**
  - Kingdom: Not applicable (Inorganic)
  - Major Constituents: Hydrated aluminum silicates, Magnesium, Iron oxide
- **Common names:** Fuller's earth, Multani mitti
- **Parts used:** Clay (processed and dried)
- **Key constituents:** Silica, Alumina, Iron oxide
- **Therapeutic uses:** Oil absorption, cleansing, cooling[3]

- **Relevance in scrub:** Removes excess oil, unclogs pores, tightens skin

7. Gram Flour (Cicer arietinum Linn.)

Fig. no.7 Gram Flour

- **Taxonomy:**
  - Kingdom: Plantae
  - Order: Fabales
  - Family: Fabaceae
  - Genus: Cicer
  - Species: Cicer arietinum
  - Synonym: Chickpea
- **Common names:** Gram flour, Besan, Chanaka
- **Parts used:** Dried seed (powdered)
- **Key constituents:** Proteins, Carbohydrates, Isoflavones, Saponins
- **Therapeutic uses:** Cleansing, exfoliation, oil regulation
- **Relevance in scrub:** Acts as the base for the formulation and provides gentle exfoliation

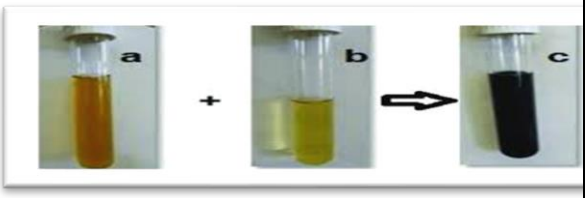
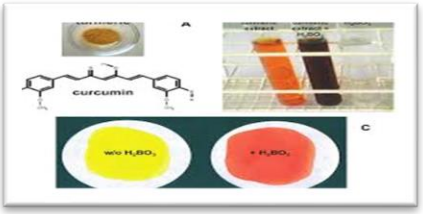
Extraction of Active Ingredients

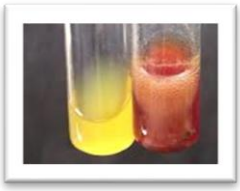
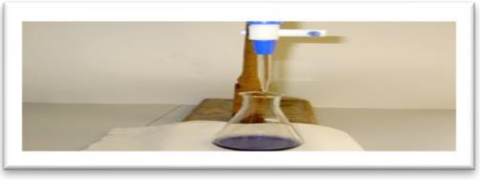
Table no.01- Extraction of Active Ingredients

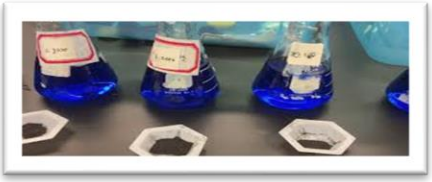
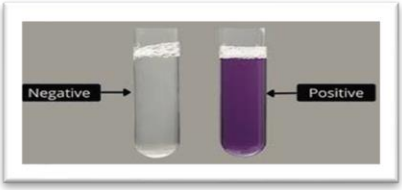
Herbal Ingredient	Drying Method	Extraction Method	Solvent Used	Key Actives Extracted
Neem (Azadirachta indica)	Shade drying	Maceration	70% Ethanol	Nimbin, Quercetin
Turmeric (Curcuma longa)	Oven drying	Soxhlet Extraction	Ethanol	Curcumin, Turmerone
Tulsi (Ocimum sanctum)	Shade drying	Infusion	Hot Water	Eugenol, Ursolic acid
Orange Peel (Citrus sinensis)	Sun drying	Maceration	70% Ethanol	Limonene, Hesperidin
Rose Petals (Rosa indica)	Shade drying	Infusion	Distilled Water	Anthocyanins, Geraniol
Multani Mitti	Sun-dried	Used as is	—	Silica, Iron oxide
Gram Flour (Cicer arietinum)	Roasted & powdered	Used as is	—	Saponins, Proteins

Identification tests

Table no.02-Identification tests

Herbal Ingredient	Phytoconstituent	Test Name	Procedure	Observation
Neem (Azadirachta indica)	Tannins	Ferric Chloride Test	Add $FeCl_3$ to aqueous extract 	Blue-black color
	Flavonoids	Shinoda Test	Add Mg + conc. HCl to extract 	Pink/red color
	Limonoids	Copper Acetate Test	Add copper acetate to extract 	Green coloration
Turmeric (Curcuma longa)	Curcuminoids	Boric Acid Test	Extract + boric acid + HCl → view under UV 	Red fluorescence
	Phenols	Ferric Chloride Test	Add $FeCl_3$ to alcoholic extract 	Bluish-black color
	Volatile oils	Sudan III Test	Add Sudan III to oil 	Orange-red color
Tulsi	Essential oils	Stain Test	Drop on paper, heat	No greasy

(Ocimum sanctum)				**spot remains**
	Flavonoids	**Alkaline Reagent Test**	**Add NaOH → then HCl** 	**Yellow turns colorless**
	Tannins	**Gelatin Test**	**Add gelatin + NaCl to extract** 	**White precipitate**
Orange Peel (Citrus sinensis)	**Flavonoids**	**Shinoda Test**	**Mg + HCl with ethanol extract** 	**Reddish color**
	Essential oils	**TLC (Rf comparison)**	**Compare spot with limonene standard** 	**Same Rf value**
	Ascorbic Acid	**DCPIP Test**	**Add extract to DCPIP** 	**Decolorization of blue dye**
Rose Petals (Rosa indica)	**Anthocyanins**	**pH Sensitivity Test**	**Add HCl and NaOH to extract** 	**Red (acid), green (alkali)**

	Volatile oils	**Stain Test**	**Drop on paper, heat** 	**No oily stain**
	Flavonoids	**Lead Acetate Test**	**Add $Pb(CH_3COO)_2$** 	**Yellow precipitate**
Multani Mitti	**Silicates**	**Acid Test**	**Add HCl to powder** 	**Slight effervescence**
	pH	**pH Test**	**Mix with water and test pH** 	**pH 6–7**
	Adsorption	**Methylene Blue Test**	**Add dye to clay suspension** 	**Color fades**
Gram Flour (Cicer arietinum)	**Proteins**	**Biuret Test**	**NaOH + $CuSO_4$ to extract** 	**Violet color**
	Saponins	**Froth Test**	**Shake with water** 	**Persistent foam (≥10 min)**

	Starch	**Iodine Test**	**Add iodine to extract** 	**Blue-black color**

Preparation of herbal scrub powder formulation

Preparation of herbal scrub powder involves drying and powdering selected herbal ingredients like neem, turmeric, tulsi, and rose petals.[4] These powders are then blended with natural exfoliants such as multani mitti and gram flour to form a uniform mixture.[5] Finally, the blend is sieved to obtain a fine herbal scrub powder ready for use.

Fig. no.8 Preparation of herbal scrub powder

Formulation table

Table no.03- Formulation table

Ingredient	Quantity (% w/w)	Role
Neem Powder	**15**	**Antibacterial, anti-inflammatory**
Turmeric Powder	**10**	**Skin brightening, antioxidant**
Tulsi Powder	**10**	**Antimicrobial, soothing**
Rose Petal Powder	**10**	**Soothing, fragrance**
Orange Peel Powder	**10**	**Exfoliant, vitamin C source**
Multani Mitti (Fuller's Earth)	**30**	**Absorbent, exfoliant**
Gram Flour (Besan)	**15**	**Exfoliant, cleansing**

Evaluation parameter

1. Organoleptic Evaluation

The formulation exhibited uniform coloration consistent with its botanical constituents. The tactile feel indicated an optimal coarse granulometry for exfoliation, while the aroma confirmed preservation of volatile phytochemicals.[6]

Table no.04- Organoleptic Evaluation

Parameter	Observation	Significance
Color	Pale yellowish-brown, uniform	Indicates consistency and correct herbal proportion
Texture	Slightly coarse, free-flowing	Suitable for gentle mechanical exfoliation
Odor	Characteristic herbal fragrance	Confirms integrity of volatile components[7]
Touch/Feel	Fine, non-irritant feel on skin	Ensures user comfort during application[8]

2. Physical Evaluation

Particle size analysis and microscopic imaging confirmed suitable granulometry and intact cellular structures.[7] Flow properties indicated good powder handling characteristics.

Table no.05 - Physical Evaluation

Parameter	Result	Technical Details
Particle Size	100–200 µm[9]	Confirmed by sieve analysis and SEM
Particle Morphology	Intact plant cells visible	SEM imaging
Angle of Repose	28°[10]	Indicates good flowability
Bulk/Tapped Density	0.45 g/mL / 0.55 g/mL[11]	Good compressibility and packing behavior

3. pH Determination

The pH of the 1% aqueous suspension was within skin-friendly limits.[12]

Table no.06 - pH Determination

Parameter	Measured Value	Ideal Range for Skin	Importance
pH of Suspension	6.2	5.5 – 7.0	Maintains skin's acid mantle integrity

4. Moisture Content

Low moisture content was achieved, essential for product stability and preventing microbial growth.[13]

Table no.07 -Moisture Content

Method	Result	Acceptable Limit	Importance
Loss on Drying (%)	2.9%	<5%	Prevents caking and microbial contamination[15]
Karl Fischer (if used)	Confirmatory low water content	N/A	Accurate water quantification

5. Microbial Load Test

Microbiological safety was confirmed through quantitative and qualitative assays.

Table no.08 - Microbial Load Test

Parameter	Result (CFU/g)	Pharmacopeial Limit	Implication
Total Aerobic Microbial Count	250 CFU/g	$<10^3$ CFU/g	Safe microbial load

Pathogens (S. aureus, P. aeruginosa)	Absent	Must be absent	Ensures safety against infections

6. Exfoliating Efficiency

Both subjective and instrumental evaluations showed effective skin exfoliation without irritation.

Table no.09 - Exfoliating Efficiency

Test	Outcome	Significance
User Sensory Feedback	Reported smooth, clean skin	Validates consumer acceptance
Skin Profilometry (Ra, Rz)	Significant decrease post-use	Objective proof of exfoliation efficacy

7. Stability Studies

Accelerated stability testing confirmed the formulation's robustness.

Table no.10 - Stability Studies

Parameter	Before Testing	After 3 Months	Acceptability
Color	Pale yellowish-brown	No significant change	Stable under accelerated conditions
Odor	Herbal fragrance	Retained	Indicates chemical stability
pH	6.2	6.1	Within acceptable range
Active Marker Content (HPTLC)	100% baseline	98%	Minimal degradation

8. Safety and Irritation Test

Patch tests showed no dermal adverse effects.

Table no.11 -Patch tests

Observation	Result	Interpretation
Erythema (Redness)	None	Non-irritant formulation
Edema (Swelling)	None	Safe for sensitive skin
Pruritus (Itching)	None	Hypoallergenic
Time Frame	72 hours observation	Confirms short-term safety

Observations:

The results from all evaluations demonstrate that the formulated herbal scrub powder meets the required quality standards for physicochemical properties, microbial safety, stability, and user acceptability. These

attributes collectively validate the herbal scrub as a safe and effective topical exfoliant suitable for commercial application.

Results and Discussion

The herbal scrub powder showed uniform color, pleasant aroma, and suitable coarse texture. Particle size and flow properties were ideal for exfoliation and handling. The pH (6.2) was skin-friendly, and moisture content was low, ensuring stability. Microbial tests confirmed safety with no harmful bacteria detected. Exfoliation was effective and non-irritating, supported by stability and patch test results. Overall, the formulation is safe, stable, and effective for skin exfoliation.

Conclusion

The formulated herbal scrub powder meets all essential quality parameters, demonstrating excellent physical stability, microbial safety, and effective exfoliating properties. Its skin-friendly pH, low moisture content, and non-irritant nature ensure safe and comfortable topical use. This natural formulation offers a promising alternative to synthetic scrubs, combining efficacy with biocompatibility, making it suitable for commercial skincare applications.

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