



Formulation and Evaluation of a Natural Aromatherapy based Serum Face mask and Charcoal Peel of mask

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ABSTRACT

The present study aimed to formulate and evaluate a natural aromatherapy-based serum face mask using herbal ingredients including Rose (*Rosa indica*), Moringa (*Moringa oleifera*), Neem (*Azadirachta indica*), Multani Mitti (Fuller's earth), Sandalwood (*Santalum album*), Aloe vera gel, and Rose water. The objective was to develop a biocompatible and eco-friendly cosmetic formulation integrating herbal biotechnology and aromatherapy for skin enhancement and relaxation. Herbal extracts were incorporated into a rose-water base to prepare a serum formulation for sheet-mask soaking and a gelatin-based peel-off mask, including a charcoal variant for comparison. The formulations were evaluated for physicochemical parameters such as pH, spreadability, viscosity, stability, and antioxidant activity using standard protocols. Aromatherapeutic response was assessed through mild blood-pressure variation analysis. The serum-based formulation (F3) showed optimal pH (5.6 ± 0.1), smooth texture, enhanced spreadability, significant antioxidant activity, and improved skin moisturization and brightness. The charcoal peel-off variant demonstrated effective cleansing properties. The findings suggest that the developed herbal serum mask is a safe, sustainable, and promising cosmeceutical formulation with potential for further clinical validation.

Keywords: Herbal Aromatherapy, Serum facemask, Cosmeceutical formulation, Antioxidant activity, Physicochemical Evaluation.

INTRODUCTION

The global cosmetics industry has experienced a substantial shift toward natural, herbal, and clean-label formulations in recent years. Consumers increasingly prefer plant-derived bioactive, reduced synthetic additives, and products supported by safety and sustainability evidence. (Kim and Lee, 2024, Green Labs Consulting, 2025). This trend is especially prominent in the skincare sector, where face masks—including serum-based sheet masks and peel-off formulations—are widely accepted as rapid, targeted treatments providing hydration, brightening, and improved skin texture. (Lokhande et al., 2024). Contemporary research highlights renewed interest in botanical ingredients such as moringa, neem, turmeric, and polyherbal blends due to their antioxidant, anti-

inflammatory, and antimicrobial properties. (Michalak, 2023, Hoang et al., 2021). Serum-based formulations offer distinct advantages over conventional creams because of their lower viscosity and higher concentration of active compounds, enabling enhanced epidermal penetration and improved sensory acceptance. (Kim and Lee, 2024).

Recent studies have demonstrated that polyherbal serum systems can maintain favorable physicochemical parameters such as pH, spreadability, and short-term stability while exhibiting significant antioxidant and antimicrobial activities relevant to skin health (Lokhande et al., 2024).

The present formulation integrates botanicals traditionally recognized for dermatological and therapeutic benefits, including Rose (*Rosa indica*), Moringa (*Moringa oleifera*), Neem (*Azadirachta indica*), Sandalwood (*Santalum album*), Multani mitti (Fuller's earth), Aloe vera, turmeric, and other supportive excipients. These ingredients contribute functions such as antioxidant protection, antimicrobial action, hydration, sebum regulation, exfoliation, and soothing effects, thereby supporting overall skin rejuvenation.

Table 1: components and their properties

COMPONENTS	PROPERTIES
Rose petals	Skin toner, aromatic agent, soothing.
Moringa (<i>Moringa oleifera</i>)	Antioxidant, Scavenge free radicals, Anti-aging. (Zhang et al., 2023).
Neem (<i>Azadirachta indica</i>)	Antimicrobial, Anti-inflammatory, Acne prone.
Sandalwood	Smoothing, cooling effect, aromaticity
Multani mitti (Fuller's earth)	Texture modifier, sebum control.
Rice flour	Exfoliator, brightening.
Parijatak (Night jasmine)	Ayurvedic use.
Gokarna	Depigmentation, Skin radiance.
Aloevera gel, glycerine, gelatin	Wound healing, hydration, film formation respectively.
Turmeric	Antiseptic and healing

Aromatherapy represents a complementary therapeutic approach that utilizes volatile plant-derived compounds to promote physiological and psychological well-being. Aromatic botanicals such as

rose and sandalwood are reported to influence the limbic system via olfactory pathways, potentially reducing stress markers and modulating autonomic responses including heart rate and blood pressure. (Herz, 2014, Lee et al., 2011).

Essential oils are rich in terpenes, phenolics, and flavonoids that exhibit antioxidant, anti-inflammatory, and antimicrobial properties, further supporting their relevance in dermatological formulations. (Pezantes-Orellana et al., 2024, Clarke and Smith, 2017). The integration of aromatherapeutic ingredients into cosmetic products therefore provides a dual functional approach—enhancing skin health while promoting relaxation and sensory satisfaction. (Sunandar et al., 2024, Happy et al., 2021).

Despite increasing interest in herbal cosmetics and aromatherapy-based skincare products, limited studies have systematically evaluated a dual-functional serum face mask combining physicochemical characterization, antioxidant assessment, and measurable aromatherapeutic response within a single formulation. Therefore, the present study aimed to formulate and evaluate a polyherbal aromatherapy-based serum face mask and compare its performance with a charcoal-based peel-off variant in terms of physicochemical properties, antioxidant activity, and relaxation response.

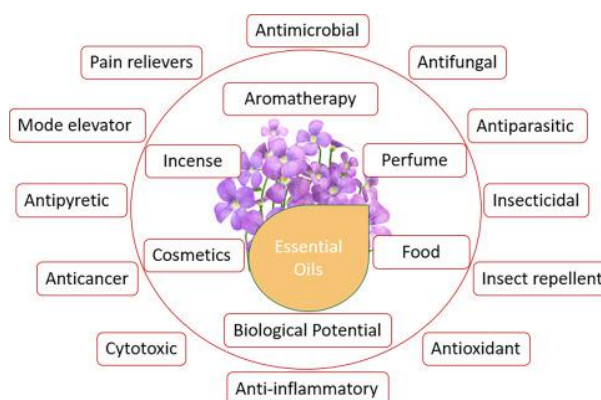


Fig 1: Outcomes of Aromatherapy

2. MATERIAL AND METHODS

2.1 Collection of Sample and Herbal Powder Preparation:

Herbal ingredients used included rose (*Rosa indica*), neem (*Azadirachta indica*), moringa (*Moringa oleifera*), sandalwood (*Santalum album*), parijat (*Nyctanthes arbor-tristis*), gokarna (*Clitoria ternatea*), Multani mitti

TABLE 2. COMPOSITION OF PEEL-OFF MASK FORMULATIONS

Components	Formulation 1 (Sandalwood based)	Formulation 2 (Skin brightening)	Formulation 3 (All-rounder)	Formulation 4 (Neem rich)
Moringa	1 g	1 g	2 g	1 g
Rice flour	2 g	5 g	3 g	1.5 g
Neem	0.5 g	0.5 g	2 g	4 g
Rose	2 g	5 g	1 g	0.5 g
Multani mitti	1 g	1 g	2 g	2 g
Sandalwood	3 g	0.5 g	1 g	0.5 g
Parijatak	0.5 g	0.5 g	1 g	0.5 g
Gokarna	0.5 g	0.5 g	1 g	0.5 g
Turmeric	0.2 g	0.3 g	0.4 g	0.5 g
Gelatin	15 – 17 g	20- 21 g	19- 20 g	15 – 17 g

(Fuller's earth), rice flour, turmeric, aloe vera gel, activated charcoal, rose water, distilled water, and glycerine. Gelatin was employed as the film-forming agent for peel-off masks, while sodium benzoate (0.1% w/v) served as preservative. Nutrient agar and DPPH reagent were used for biological assays. Plant materials were washed with distilled water, shade-dried, and oven-dried at 40–45°C to preserve phytoconstituents. The dried samples were pulverized and sieved to obtain uniform particle size suitable for formulation (Ajay et al., 2023).

2.2 Preparation of Herbal Serum (Sheet Mask Base):

Specified quantities of herbal powders were dispersed in rose water–distilled water mixture containing aloe Vera gel and glycerine. The mixture was stirred for 15–20 min for extraction and filtered multiple times to obtain a clear serum. Sodium benzoate (0.1% w/v) was added as preservative, and the formulation was stored in airtight containers. Sterile dry sheet masks were soaked in the prepared serum and packed in sterile pouches. (Maniyar et al., 2025, Krishnan et al., 2025).

2.3 Preparation of Peel-Off Mask:

Four peel-off formulations were developed using gelatin as the film-forming base, each designed for specific functional properties. Herbal powders were blended with rose water to form a paste, followed by incorporation of dissolved gelatin under continuous stirring. The mixture was cooled to obtain a semi-viscous consistency. For the charcoal variant, activated charcoal (1 g) was incorporated before gel setting. (Krishnan et al., 2025, Patel et al., 2025).

2.4 Physicochemical Evaluation

Formulations were evaluated for:

- Physical appearance and texture (color, odor, homogeneity).
- pH using a calibrated digital pH meter (ideal range 5.0–6.5).
- Spreadability using the glass plate method ($S = M \times L / T$).
- Viscosity and texture by visual/manual assessment.
- Drying time (peel-off mask) by recording film formation time on forearm.
- Stability by observing physical changes and microbial growth over two weeks at room temperature (Badgular & Patil, 2024).
- Patch test on inner forearm to assess irritation potential (Cai et al., 2004).

2.5 Biological Evaluation

- Antimicrobial Activity:** Determined by agar well diffusion method against *Staphylococcus aureus* and *E. coli* using nutrient agar. Zones of inhibition were measured after 24 h incubation at 37°. (Adoor, 2017, Glaser, 2004, Poljšak et al., 2012).
- Antioxidant Activity (DPPH Assay):** Sample extracts were reacted with 0.1 mM DPPH solution and incubated for 30 min in the dark. Absorbance was measured at 517 nm, and % scavenging activity was calculated (A_0 = control; A_1 = sample). (Blois, 1958, Adoor, 2017, Glaser, 2004, Poljšak et al., 2012).
- Aromatherapy Assessment:** Blood pressure of volunteers was recorded before and 15 min after serum mask application. Reduction in systolic and

diastolic values indicated relaxation due to aromatic components. (Olivero-Verbel et al., 2024).

2.6 Comparative Study:

A comparative analysis between the serum-based sheet mask and charcoal peel-off mask was conducted based on application ease, irritation potential, hydration, cleansing efficacy, and aroma-induced relaxation. User sensory feedback was collected for qualitative evaluation.

RESULTS

3.1. Natural materials used: Figures 2 illustrate the collection of rose, tuberose, mogra, and parijatak, along with naturally prepared powders and ingredients. These materials formed the basis of serum and peel-off mask formulations.

3.2 Preparation of serum:

The herbal serum prepared for sheet masks was clear and homogenous after repeated filtration, with a pH in

the skin-compatible range of 5.5–6.5. It remained stable during storage without microbial growth or phase separation, and the sheet masks absorbed the serum uniformly while retaining moisture effectively.

3.3 Preparation of peel off face mask:

The peel-off mask formulations produced smooth films with good peelability and adherence. The gelatin base ensured consistent texture, while the herbal variants showed distinct coloration. The charcoal formulation displayed uniform dispersion of activated charcoal and demonstrated enhanced cleansing properties.

3.4 Physicochemical Evaluation:

Physical Appearance and Texture:

All formulations were visually evaluated for color, odor, texture, and homogeneity. The serum base appeared light brown to pale yellow with a pleasant floral fragrance. Peel-off masks showed uniform dispersion with smooth to creamy texture and characteristic herbal odor. No phase separation or microbial growth was observed during two weeks of storage.



Fig 2: Collection of herbal ingredients and powder preparation.

Table 3: Study of physical appearance and texture.

Formulation code	Appearance	Texture	Odour	Homogeneity
Serum Base	Light brown	Translucent, smooth	Pleasant, floral	(Rose, sandalwood) homogenous
Peel off: F1 (Sandalwood)	Light brown	Thick, Creamy	Mild woody	Uniform
F2 (Brightening)	Yellowish brown	Moderate viscosity	Mild, floral	Uniform
F3 (Allrounder)	Greenish brown	Smooth, glossy	Refreshing herbal	Uniform
F4 (Neem rich)	Greenish	Thick paste	Slightly bitter herbal	Uniform
Charcoal variant	Black	Smooth gel	Mild mogra essence	Uniform



Fig 3: F1, F2, F3 and F4 formulation.



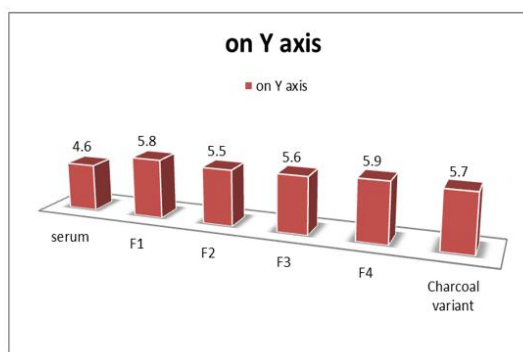
Fig 4: Charcoal variant

Table 4: pH determination of serum and peel off.

Formulation	Observed pH (Mean $\pm$ SD)	Inference
Serum Base	4.6 $\pm$ 0.1	Skin-compatible
F1 (Sandalwood)	5.8 $\pm$ 0.2	Acceptable
F2 (Brightening)	5.5 $\pm$ 0.1	Ideal
F3 (All-rounder)	5.6 $\pm$ 0.1	Ideal
F4 (Neem-rich)	5.9 $\pm$ 0.2	Acceptable



Fig 5: pH determination using pH meter



Graph 1: pH determination

Table 5: Observed drying time.

Formulation	Drying Time (min)	Observation
F1	15 $\pm$ 0.5	Normal
F2	14.5 $\pm$ 0.3	Slightly faster
F3	15 $\pm$ 0.2	Normal
F4	15 $\pm$ 0.4	Normal
Charcoal variant	12.5 $\pm$ 0.2	Fast drying

pH Determination:

All formulations exhibited pH values within the skin-compatible range (4.6–5.9), indicating suitability for topical application.

Spreadability:

Spreadability was determined using the slide-glass method shown in figure 6.

Peel-off mask:

$$S = M \times L / T = 10 \times 3.5 / 5 = 7 \text{ g-cm/sec}$$

Indicates good consistency and ease of application.

Serum-based sheet mask:

$$S = 10 \times 5 / 5 = 10 \text{ g-cm/sec}$$

The serum showed higher spreadability (10 g-cm/sec) compared to peel-off masks (7 g-cm/sec), indicating smoother texture and easier application.

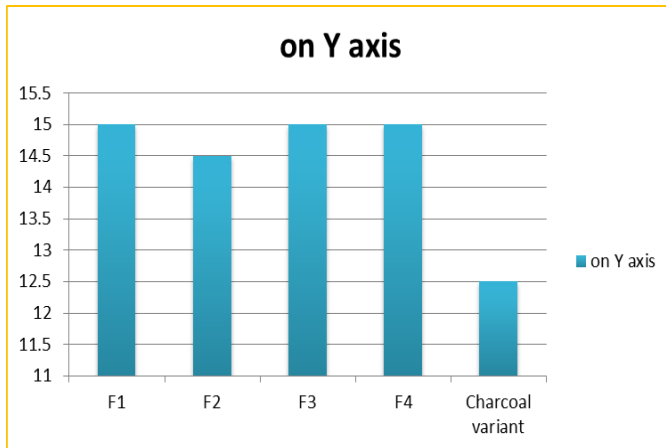
Drying Time: Drying time was recorded for peel-off formulations. The charcoal variant demonstrated faster drying due to higher absorbent properties as shown in figure 7.



Fig 6: Spreadability test



Fig 7: Drying time determination



Graph 2: Drying time

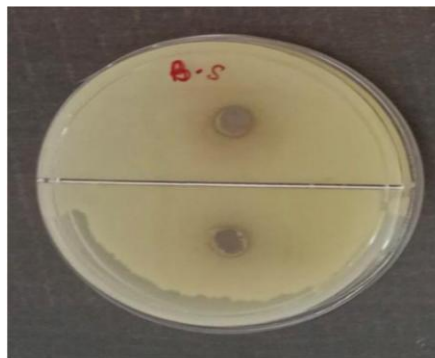
Additional Observation:

Normal peel-off mask: 20 minutes

Charcoal peel-off mask: 15 minutes



Fig 8: Peel off test



a



b

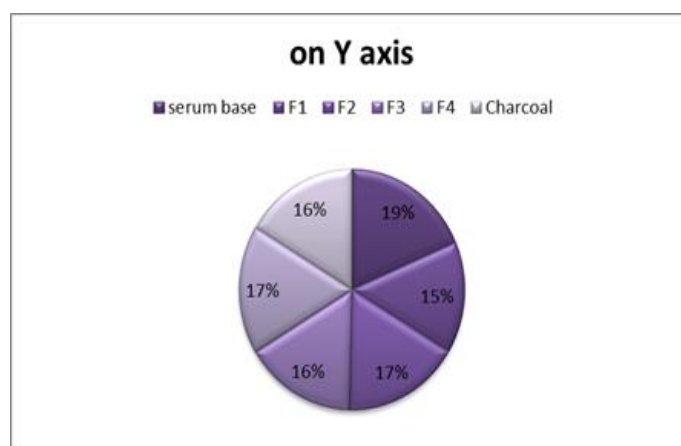
Fig 9: Antimicrobial activity shown by (a) *Bacillus subtilis* and (b) *S. aureus*

Table 6: Antioxidant Activity.

Formulation	% Inhibition of DPPH	Antioxidant Potential
Serum Base	68.2	Strong
F1	55.3	Moderate
F2	61.5	High
F3	58.7	Moderate
F4	63.4	Strong
Charcoal variant	60.2	High



Fig 10: Antioxidant assay (DPPH assay)



Graph 3: DPPH assay

3.5 a. Antimicrobial Activity:

Antimicrobial activity was evaluated against *E. coli*, *S. aureus*, *B. subtilis*, and *Pseudomonas* strains. Moderate to strong zones of inhibition were observed, particularly in the Neem-rich (F4) and Serum Base formulations, indicating effective antimicrobial potential.

b. Antioxidant Activity (DPPH Assay):

All formulations exhibited measurable antioxidant activity, indicating the presence of phenolic and flavonoid compounds. The serum base and F4 showed the highest free radical scavenging activity.

c. Aromatherapy Effect (Blood Pressure Analysis):

Blood pressure was recorded before and after mask application in five volunteers. A mild reduction in systolic and diastolic values was observed, suggesting relaxation effects.

3.6 Comparative Analysis

The serum-based mask demonstrated superior hydration, spread ability, antioxidant activity, and relaxation response. The charcoal peel-off mask showed faster drying and enhanced cleansing properties.

Table 7: Aromatherapy effect on blood pressure.

Volunteer	BP Before (mmHg)	BP After (mmHg)	Difference	Interpretation
1	118/76	115/74	↓3/2	Relaxed
2	122/80	118/78	↓4/2	Relaxed
3	116/72	113/70	↓3/2	Relaxed
4	120/78	117/75	↓3/3	Relaxed
5	124/89	121/85	↓3/4	Relaxed



Fig 11: BP Analysis

TABLE 8: COMPARATIVE ANALYSIS OF SERUM AND PEEL OFF FACE MASK.

Parameter	Serum Mask	Charcoal Peel-Off Mask	Inference
Texture	Smooth, lightweight	Slightly thick	User preference: Serum Drying Time:12–13 min Charcoal faster
Ease of Removal	Easy	Easy, less painful	Both suitable
Skin Feel After Use	Moisturized, glowing	Clean, oil-free	Both effective
Aroma Effect	Strong floral aroma	Mild herbal	Serum superior
Relaxation Response	Noticeable	Mild	Serum superior

DISCUSSION

The present study successfully formulated and evaluated novel herbal face masks, including a serum-based sheet mask and multiple peel-off variants (sandalwood-focused, skin-brightening, all-rounder, neem-rich, and charcoal-infused). The formulations were designed as multifunctional natural cosmetics integrating herbal bioactives with aromatherapeutic benefits to enhance skin health and relaxation.

4.1 Physicochemical Performance

All formulations exhibited physicochemical properties suitable for topical application. The pH range (5.4–6.0) was within the normal skin-compatible range, indicating safety and minimal irritation potential. Good spreadability, homogeneity, and smooth texture ensured ease of application and uniform distribution. Peel-off masks showed acceptable drying times (~15 min), while charcoal variants demonstrated slightly faster film formation (12–13 min), likely due to the adsorptive and porous nature of activated charcoal that facilitates moisture evaporation. This suggests the feasibility of developing rapid-drying peel-off systems without compromising consistency.

4.2 Biological Efficacy

Antioxidant and antimicrobial studies confirmed the biofunctional potential of the herbal ingredients. Moringa- and rose-rich formulations exhibited strong antioxidant activity, attributable to their phenolic and flavonoid constituents, which support free radical scavenging and skin protection. Neem- and sandalwood-based masks demonstrated notable antibacterial activity, validating their traditional application in acne and microbial skin conditions. The polyherbal combinations enhanced overall protective and restorative properties, supporting their cosmeceutical relevance.

4.3 Aromatherapy and Psychological Impact

A key outcome of this study was the demonstration of aromatherapy-associated physiological effects. A mild but consistent reduction in systolic and diastolic blood pressure following application of rose- and sandalwood-enriched masks indicated a measurable relaxation response. These findings emphasize the dual dermatological and psychophysiological benefits of aromatic botanicals, supporting their role in stress reduction, mood enhancement, and holistic skincare.

4.4 Overall Outcome

Overall, the serum-based sheet mask showed superior hydration, antioxidant potential, and relaxation effects, making it suitable for routine skin nourishment. In contrast, the charcoal peel-off mask provided enhanced detoxification and oil control, making it appropriate for periodic deep cleansing. The integration of herbal biotechnology with aromatherapeutic principles highlights the potential of these formulations as sustainable and multifunctional natural cosmetic products.

CONCLUSION

The present study successfully formulated and evaluated novel herbal face mask systems, including a serum-based sheet mask and four functional peel-off variants enriched with selected botanical and aromatic ingredients. The research addressed the need for scientifically validated, multifunctional natural cosmetic formulations integrating dermatological efficacy with measurable aromatherapeutic effects.

All developed formulations exhibited favorable physicochemical characteristics, including skin-compatible pH (4–6), smooth texture, appropriate viscosity, and good spreadability, ensuring safety and user acceptability. The charcoal-infused peel-off mask demonstrated relatively faster drying time (15–20 minutes), indicating practical suitability for convenient application. Biological evaluation confirmed significant antioxidant and antimicrobial activities. The serum-based mask showed the highest antioxidant potential, suggesting effectiveness in combating oxidative stress and supporting skin rejuvenation. Neem- and sandalwood-based peel-off formulations demonstrated notable antibacterial activity, supporting their traditional use in acne management and microbial control.

Importantly, the incorporation of aromatherapy assessment revealed a mild yet consistent reduction in systolic and diastolic blood pressure among volunteers following application of rose-, mogra-, and sandalwood-enriched formulations. This finding underscores the dual dermatological and psychophysiological benefits of the developed masks, bridging skincare and holistic wellness. Overall, the study provides scientific validation for the integration of cosmeceutical and aromatherapeutic principles into

herbal skincare products. The formulated masks represent safe, natural, and multifunctional candidates for skin health enhancement and stress relief. Future investigations focusing on large-scale clinical trials, long-term stability studies, and mechanistic evaluation will further substantiate their therapeutic and commercial potential.

Conflict of interest

The authors declare no competing interests.

Data Availability Statement: Not applicable.

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