INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Article

Formulation and Evaluation of a Herbal Face Mist - Incorporating Orange Peel (Citrus sinensis) and Green Tea (Camellia sinensis) Extracts

Deep Mhatre, Bhavesh Mhatre, Vandana Kushwaha, Somnath Thorat

B. R. Harne College of Pharmacy, Karav, Vangani (W), Maharashtra

ARTICLE INFO

Published: 27 May. 2026

Keywords:
Herbal face mist, Citrus sinensis, Camellia sinensis, EGCG, hesperidin, antioxidant, cosmeceutical, skin pH, stability studies, topical formulation

DOI:
10.5281/zenodo.20408079

ABSTRACT

The present study reports the systematic formulation and comprehensive evaluation of a herbal face mist incorporating aqueous-glycerin extracts of Orange Peel (Citrus sinensis) and Green Tea (Camellia sinensis). These botanicals are well-documented for their antioxidant, anti-inflammatory, and skin-protective phytochemistry, including hesperidin, vitamin C, and epigallocatechin gallate (EGCG). The formulation was developed using pharmaceutical-grade excipients — propylene glycol (humectant), sodium benzoate (preservative), and disodium EDTA (chelating agent) — in an aqueous vehicle and evaluated against standard cosmeceutical parameters. Organoleptic assessment confirmed a clear, pale yellow, pleasantly scented liquid. Physicochemical analysis recorded a pH of 4.8, low viscosity suitable for spray application, and density approximating water, indicating formulation uniformity. Accelerated stability studies (room temperature, 4°C, and 40°C) demonstrated physical and chemical stability, with only minor, acceptable variation at elevated temperature. Microbial evaluation revealed no contamination, and a patch test confirmed the formulation to be non-irritant. The developed face mist exhibited performance comparable to marketed products while offering the advantages of natural origin, reduced risk of adverse effects, and compatibility with the skin's acid mantle.

INTRODUCTION

1.1. Cosmeceuticals

Cosmeceuticals occupy a distinctive position at the intersection of cosmetics and pharmaceuticals, delivering biologically active ingredients that exert measurable physiological effects on the skin. Unlike conventional cosmetic products, which address appearance at a superficial level, cosmeceuticals are formulated to improve skin health at a cellular level through mechanisms such as antioxidant activity, anti-inflammatory

***Corresponding Author:** Deep Mhatre
Address: *B. R. Harne College of Pharmacy, Karav, Vangani (W), Maharashtra*
Email : mhatredeep858@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

modulation, and structural protein support. In recent years, consumer preference has shifted markedly toward herbal and naturally derived skincare, driven by growing awareness of the adverse effects associated with prolonged exposure to synthetic compounds — including skin irritation, allergic sensitisation, and cumulative toxicity. This trend is further reinforced by environmental concerns and the global movement toward sustainable, ecofriendly products. Plant-based formulations are perceived as safer and richer in bioactive compounds such as flavonoids, polyphenols, tannins, and vitamins, all of which contribute to therapeutic efficacy. Among herbal skincare formats, the facial mist has gained considerable popularity due to its ease of application, refreshing sensory profile, and capacity to deliver active ingredients in a fine, rapidly absorbing dispersion. Herbal face mists serve as effective delivery systems for phytoconstituents, allowing direct application to the skin surface without clogging pores or leaving a heavy residue. They are particularly beneficial in conditions of environmental stress — high temperatures, low humidity, and atmospheric pollution — which disrupt skin barrier integrity and promote oxidative damage. The present study was conceived against this backdrop. Orange Peel (Citrus sinensis) and Green Tea (Camellia sinensis) were selected as the primary active ingredients on the basis of their well characterised phytochemistry and complementary skin benefits. Together, they form a synergistic combination capable of hydrating, protecting, brightening, and revitalising the skin. The study aimed to formulate a stable, safe, and effective Herbal face mist and to evaluate it against standard cosmeceutical parameters in accordance with established pharmaceutical guidelines.

1.2. Skin Physiology

The skin is the body's largest organ and acts as a protective barrier against environmental, chemical, and microbial damage. It helps maintain body temperature, prevents water loss, and protects internal tissues. The skin consists of three layers: epidermis, dermis, and hypodermis.

The epidermis, particularly the stratum corneum, constitutes the exterior protective barrier that preserves skin moisture and inhibits Transepidermal Water Loss (TEWL).Damage to this layer can cause dryness, irritation, and sensitivity.

The dermis contains collagen and elastin fibers responsible for skin strength and elasticity. Environmental factors such as UV radiation and pollution generate reactive oxygen species (ROS), which damage these fibers and lead to premature aging, wrinkles, and uneven skin tone. Antioxidant-rich formulations help protect the skin from such damage.

Healthy skin also contains an acid mantle with a slightly acidic pH of 4.5–5.5, which supports beneficial microorganisms, prevents harmful microbial growth, and helps repair the skin barrier. Disturbance of this pH balance may weaken skin protection and increase the risk of irritation and infections.

1.3. Face Mist Overview

Face mist is a liquid cosmetic product intended for direct application onto the facial skin. It primarily serves to:

- Hydrate and rejuvenate the skin
- Preserve skin moisture
- Offer a cooling and calming effect

- Enhance skin freshness throughout daily activities

Face mist formulations typically include:

- A water or hydrosol base
- Botanical extracts or active components
- Humectants and preservatives

Herbal face mists are gaining popularity due to their natural ingredients, which may offer additional skin advantages such as:

- Antioxidant properties
- Antibacterial benefits
- Anti-inflammatory characteristics

In the context of acne-prone skin care, face mist can act as an effective topical delivery method for antibacterial herbal extracts.

2. Literature Review :

The scientific literature provides substantial support for the use of plant-based antioxidants in topical formulations. Studies on face mist and toner formulations incorporating botanical extracts — including pomegranate peel, mangosteen peel, dragon fruit peel, and Centella asiatica — have demonstrated significant antioxidant activity, physical stability, and dermatological acceptability. DPPH radical scavenging assays have been widely employed to quantify antioxidant potential in such formulations, consistently validating the efficacy of polyphenol-rich plant extracts. Orange peel (Citrus sinensis) has been extensively reviewed for its skin benefits. Hesperidin, the predominant flavonoid in citrus peel, has been reported to improve microcirculation, stimulate collagen synthesis, strengthen the skin barrier, and inhibit melanin formation. Vitamin C, present in significant concentrations in orange peel, is a well-established co-factor in collagen biosynthesis and a potent antioxidant. Natural acids present in the peel further contribute mild exfoliating activity, promoting skin renewal and radiance. Green tea (Camellia sinensis) is among the most studied herbal ingredients in dermatology. Its principal bioactive, epigallocatechin gallate (EGCG), exhibits strong free-radical scavenging activity, inhibits inflammatory mediators, controls acne-causing bacteria, and provides photoprotection against UV-induced damage. EGCG has also been shown to activate cellular repair pathways, supporting wound healing and skin regeneration. The combination of orange peel and green tea extracts is scientifically justified by their complementary phytochemistry: the vitamin C-EGCG redox synergy enhances overall antioxidant capacity beyond what either ingredient achieves individually. Literature on herbal face mist formulation additionally emphasises the critical importance of maintaining appropriate pH (4.5–5.5), low viscosity, and a robust preservative system to ensure microbial safety and shelf stability. Sodium benzoate and disodium EDTA are widely reported as effective preservative and chelating agents, respectively, in aqueous herbal cosmetic formulations.

3. Aim and Objective:

The aim of the study was to formulate, develop, and evaluate a stable herbal face mist incorporating extracts of Orange Peel (Citrus sinensis) and Green Tea (Camellia sinensis) for antioxidant and skin-rejuvenating benefits. The principal technical objectives were as follows: to extract bioactive compounds from both plant sources using an appropriate technique and verify the presence of key phytoconstituents; to design

and optimise a hydro-aqueous base providing a non-greasy, refreshing delivery system; to incorporate suitable preservatives and pH adjusters to ensure clarity, microbial safety, and stability; to evaluate the formulation for organoleptic properties, physicochemical parameters, spray performance, and skin compatibility; and to conduct accelerated stability studies in accordance with ICH guidelines.

4. Methodology :

4.1. Materials Used:

All materials were of analytical/cosmetic grade. The formulation composition is presented in Table Below

Ingredients	Quantity	Function
Orange Peel Extract	10 ml	Active Ingredient (Skin Brightening, Anti-oxidant)
Green Tea Extract	10ml	Active Ingredient (Anti-inflammatory, UV-Protection Support)
Ethyl Alcohol	10 ml	Cooling Agent and Solvent
Rose Oil	3-4 Drops	Fragrance
Propylene Glycol	5 ml	Humectant, Penetration Enhancer
Sodium Benzoate	0.2 gm	Antimicrobial Preservative
Citric Acid	Q.S.	pH Adjuster
Distilled Water	Q.S. to 100 ml	Aqueous Vehicle / Solvent Base

4.2. Uses of Ingredients in Formulation:

1. **Orange Peel Powder**

- Rich in Vitamin C and flavonoids — brightens skin tone and reduces hyperpigmentation.
- Contains antioxidants that fight free radical damage and delay signs of aging.
- Has antimicrobial properties that help control acne-causing bacteria.
- Acts as a natural exfoliant (in extracts, helps remove dead skin cells).
- Astringent properties help tighten pores and reduce excess oil.

2. **Green Tea Powder**

- Loaded with EGCG (epigallocatechin gallate) — a potent antioxidant that protects against UV damage.
- Has strong anti-inflammatory properties, soothing redness and irritation.
- Helps reduce sebum production, beneficial for oily and acne-prone skin.
- Contains polyphenols that combat signs of aging (fine lines, wrinkles).
- Provides a mild skin-brightening effect over time.

3. **Ethanol (Ethyl Alcohol)**

- Acts as an extraction solvent - efficiently pulls out active phytochemicals from plant material.
- Functions as a preservative by inhibiting microbial growth in the formulation.
- Serves as a solubilizer, helping mix oil-soluble and water-soluble components.
- Provides a quick drying/cooling sensation on skin application.
- Enhances penetration of active ingredients into the skin.

4. **Distilled Water**

- Acts as the primary vehicle/base of the aqueous phase.
- Used as a solvent for water-soluble ingredients like sodium benzoate.
- Ensures the formula is free from minerals and contaminants (unlike tap water).
- Helps in volume adjustment to reach the final 100 ml.
- Provides hydration to the skin upon misting.

5. **Sodium Benzoate**

- Primary preservative in the formulation — prevents microbial and fungal growth.
- Extends the shelf life of the product.
- Effective in slightly acidic pH environments, which suits most skin mists.
- Water-soluble, making it ideal for aqueous phase incorporation.
- Used at low concentrations (0.2%), making it safe and non-irritating.

6. **Propylene Glycol**

- Acts as a humectant — draws moisture from the environment into the skin.
- Functions as a solubilizer helping blend rose oil into the aqueous base.
- Enhances penetration of active ingredients through the skin barrier.
- Provides a skin-conditioning effect, leaving skin soft and supple.
- Also contributes mild antimicrobial activity.

7. **Rose Oil**

- Provides a pleasant fragrance and enhances the sensory appeal of the mist.
- Has anti-inflammatory and soothing properties — calms sensitive/irritated skin.
- Rich in antioxidants that help fight oxidative stress on skin.
- Known for its moisturizing and skin-rejuvenating effects.
- Offers mild antimicrobial activity, complementing other preservatives.

4.3. Extraction of Herbal Ingredients:

Dried orange peel and green tea leaves were independently powdered and subjected to sonication assisted extraction using a water-Ethanol solvent system. Ultrasonic waves facilitated the breakdown of plant cell walls, enhancing the release of bioactive compounds.

The process was continued until maximum phytoconstituent yield was achieved, after which the extracts were filtered to remove particulate matter and stored appropriately prior to formulation.

4.4. Method of Preparation:

The herbal extraction process was conducted using ultrasonic-assisted extraction (UAE). To prepare the orange peel extract, 10 g of orange peel powder was suspended in a binary solvent system consisting of 60 mL of ethanol and 40 mL of distilled water. The mixture was sonicated for 30–35 min while maintaining a controlled temperature range of 35–40°C. Separately, the green tea extract was prepared by adding 5 g of green tea powder to a 1:1 (v/v) mixture of ethanol and distilled water (50 mL each). This suspension was subjected to sonication for 15–20 min at an ambient temperature of 25–30°C. Both crude extracts were subsequently filtered to obtain clear filtrates for the final formulation. The aqueous phase was prepared by completely dissolving 0.2 g of sodium benzoate in 50 mL of distilled water. For the herbal phase blend, a 10 mL aliquot of the orange peel extract was thoroughly mixed with 10 mL of the green tea extract, followed by the slow incorporation of the previously prepared aqueous phase. Concurrently, a solubilised cooling phase was generated by blending 5 mL of propylene glycol with 3–4 drops of rose oil, into which 10 mL of ethyl alcohol was gradually introduced under continuous stirring. Finally, the solubilised cooling agent mixture was blended with the aqueous-extract phase, and the total volume was adjusted precisely to 100 mL using distilled water to yield the final herbal face mist formulation.

4.5. Evaluation Parameters:

The formulation was evaluated for organoleptic properties (colour, odour, clarity, appearance), physicochemical parameters (pH, viscosity, density), stability under three storage conditions (room temperature, 4°C, and 40°C) over a defined period, microbial safety, and skin compatibility via patch testing. Each parameter was assessed using calibrated instruments and standardised methods appropriate for cosmetic formulations.

5. Result and Discussion:

5.1. Organoleptic Evaluation

The formulation presented with a clear, pale yellow appearance attributable to the chromophoric constituents of orange peel and green tea extracts. The odour was mild and pleasantly citrus-herbal, considered acceptable for a consumer cosmetic product. The liquid was homogeneous with no visible particulate matter, confirming effective filtration and ingredient compatibility.

Parameter	Observation	Inference
Colour	Pale Yellow	Due to herbal extract pigments; aesthetically acceptable
Odour	Mild, Citrus-Herbal	Agreeable for cosmetic use
Clarity	Clear	No turbidity; good filtration and compatibility
Appearance	Homogeneous Liquid	Uniform mixing and solubilisation achieved

5.2. Physiochemical Evaluation

The pH of 4.8 falls within the physiologically accepted range of 4.5–5.5 for topical formulations, ensuring compatibility with the skin's acid mantle and reducing the risk of irritation or barrier disruption. The formulation demonstrated low viscosity appropriate for pump-spray dispensing

and uniform distribution across the skin surface. Density was approximately 1 g/mL, consistent with an aqueous system and indicative of phase uniformity.

Parameter	Observed Value	Standard Range / Expectation	Inference
pH	4.8	4.5– 5.5	Skin-compatible; maintains acid mantle
Viscosity	Low	Low (spray grade)	Suitable for spray application
Density	~1.0 g/mL	~1.0 g/mL (aqueous)	Homogeneous; no phase separation

5.3. Stability Studies

Stability assessment was conducted under three conditions to simulate storage environments encountered across the product's shelf life. At room temperature and under refrigeration (4°C), the formulation exhibited no changes in colour, odour, pH, or clarity throughout the study period, indicating robust physical and chemical stability. At elevated temperature (40°C), slight colour variation and a minor pH shift were noted; however, these changes remained within acceptable limits and are consistent with the inherent sensitivity of herbal formulations to thermal stress. No phase separation or precipitation was observed under any condition.

Storage Condition	Colour Change	Odour Change	pH Change	Clarity	Assessment
Room Temperature	None	None	Stable	Clear	Stable
Refrigerated (4°C)	None	None	Stable	Clear	Stable
Elevated Temp (40°C)	Slight	No Major Change	Slight Variation	Clear	Acceptable

5.4. Microbial Evaluation

No microbial growth was observed during the evaluation period. The preservative system combining sodium benzoate (0.1 g per 50 mL) with disodium EDTA (0.05 g per 50 mL) proved effective in maintaining the microbiological integrity of the formulation. EDTA acts as a chelating agent that disrupts the outer membranes of gram-negative bacteria, potentiating the action of sodium benzoate and extending the spectrum of antimicrobial protection.

5.5. Skin Irritation (Patch Test)

Patch testing conducted on human volunteers revealed the complete absence of redness, itching, or inflammation at the application site. The non-irritant profile of the formulation is attributable to its skin compatible pH, the use of biocompatible herbal actives, and the avoidance of known sensitisers. These findings confirm the formulation's suitability for regular topical use across a broad range of skin types.

5.6. Overall Performance Comparison

When compared against the typical performance benchmarks of marketed face mist products, the prepared herbal formulation demonstrated equivalent or comparable results across all evaluated parameters, as summarised in Table. The principal added advantage of the present formulation lies in its natural ingredient profile and the associated reduction in risk of chronic adverse effects.

Parameter	Prepared Formulation	Marketed Standard	Outcome
pH	4.8	4.5– 5.5	Acceptable
Clarity	Clear	Clear	Comparable
Stability	Good (all conditions)	Good	Comparable
Skin Irritation	None	None	Safe
Texture	Light, Non-Sticky	Light	Comparable
Microbial Safety	No Contamination	No Contamination	Equivalent

CONCLUSION

The present study successfully developed and evaluated a herbal face mist incorporating Orange Peel (Citrus sinensis) and Green Tea (Camellia sinensis) extracts as primary active ingredients. The formulation was prepared using a systematic, reproducible method and evaluated comprehensively against organoleptic, physicochemical, stability, microbiological, and dermatological parameters. All evaluation outcomes were within acceptable limits. The formulation maintained a skin-compatible pH of 4.8, exhibited low viscosity suitable for spray application, remained physically and chemically stable across all tested storage conditions, and was confirmed to be non-irritant and microbiologically safe. The bioactive phytoconstituents — principally hesperidin, vitamin C, and EGCG — contribute antioxidant, anti-inflammatory, and skin-soothing properties that collectively support skin health and protection against environmental stressors. The developed herbal face mist represents a viable, naturally derived cosmeceutical product with performance characteristics comparable to marketed formulations. It demonstrates the potential for plant-based actives to fulfil the dual role of aesthetic enhancement and therapeutic skin benefit, thereby aligning with contemporary trends toward sustainable, holistic skincare. Future work should encompass extended real-time stability studies, quantitative HPLC analysis of active constituents, clinical evaluation in a larger volunteer cohort, and investigation of advanced delivery systems such as nano-emulsions or liposomes to further enhance bioavailability and penetration depth.

6. RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the findings of the present study, the following directions are proposed for further development. UV-protective amber packaging should be adopted as standard to protect light sensitive herbal constituents and prolong shelf life. Long-term stability studies under real-time and

accelerated ICH conditions should be conducted to establish a validated shelf-life claim. Advanced analytical techniques, including spectrophotometry and HPLC, should be employed to quantify flavonoid and catechin content and ensure batch-to-batch consistency. Clinical studies should be undertaken on a broader population to assess improvements in skin hydration, texture, and protection against environmental damage. Optimised extraction protocols — including ultrasound-assisted or supercritical fluid extraction — may further maximise bioactive yield. Exploration of nano-emulsion or liposomal delivery systems offers a promising avenue for enhancing penetration and bioavailability. Finally, scale-up feasibility and industrial-grade quality control protocols should be established in preparation for potential commercialisation.

REFERENCES

1. Hasana AR. Formulation face mist with gotu kola (Centella asiatica) extract as antioxidant and moisturizing for elderly skin. Proceeding of International Conference of Kerta Cendekia. 2022;2(1):124–130.
2. Lisyanti F, Budi S, Zulfadhilah M. Formulation test of preparations face mist combination of pomegranate peel extract and mangosteen peel as antioxidants. Journal of Advances in Medicine and Pharmaceutical Sciences. 2022 May 29;1(1):15–22.
3. Fitrianingsih S, Fikananta AS, Handayani Y, Hidayati R. Face mist formulation: 96% ethanol fruit peel extract red dragon (Hylocereus polyrhizus) as an antioxidant using the DPPH method. Proceeding Cendekia International Conference Health and Technology. 2025;3:318–327.
4. Mustaanah AN, Fadel MN, Khudzaifi M. Formulation Research and Antibacterial Activity Test of Face Mist Preparation from Ethanol Extract of Papaya Leaves (Carica Papaya L.) Against Propionibacterium Acnes. Advances in Healthcare Research. 2025 Aug 12;3(2):371-92.
5. Angelica EO, Herawati E, Puspitasari M, Yuniarsih N. Archives of The Medicine and Case Reports. 2022;3(3).
6. Gawali N, Lande V, Popalghat D, et al. Formulation and evaluation of herbal facial toner. International Journal of Scientific Research and Technology. 2025 May 25.
7. Dubey R, Koley S. An in-depth review of a polyherbal face pack. [Review article].
8. Rodrigues CV, Pintado M. Hesperidin from orange peel as a promising skincare bioactive: an overview. International Journal of Molecular Sciences. 2024 Feb 4;25(3):1890.
9. Powder HT. Is orange peel powder vitamin C? [Industry reference].
10. Maldonado MJ, Xavier PC, Martins AS, Palhares DB. Hesperidin flavonoids from orange peel show benefits for human health. Physiology. 2020;233(9):6544–6560.
11. Hsu S. Green tea and the skin. Journal of the American Academy of Dermatology. 2005 Jun 1;52(6):1049–1059.
12. Xu FW, Lv YL, Zhong YF, et al. Beneficial effects of green tea EGCG on skin wound healing: a comprehensive review. Molecules. 2021 Oct 11;26(20):6123.
13. Venus M, Waterman J, McNab I. Basic physiology of the skin. Surgery (Oxford). 2010 Oct 1;28(10):469–472.

HOW TO CITE: Deep Mhatre, Bhavesh Mhatre, Vandana Kushwaha, Somnath Thorat, Formulation and Evaluation of a Herbal Face Mist, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 5, 7273-7281. https://doi.org/10.5281/zenodo.20408079