IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 7, October 2026
Impact Factor: 8.2

Formulation and Evaluation of Herbal Facial Toner: Review Paper

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Abstract: *A facial toner is a water-based, non-greasy cosmetic preparation applied after cleansing to remove residual impurities, restore the skin's natural acidic pH, hydrate and prepare the skin for subsequent products. Conventional toners frequently contain high levels of alcohol, synthetic fragrances and preservatives that may cause dryness, irritation and sensitisation. Growing consumer preference for natural products has therefore increased interest in herbal toners based on plant extracts, hydrosols and botanical actives such as rose, aloe vera, green tea, cucumber, witch hazel, neem and chamomile. This review summarises the physiology of facial skin and the rationale for toner use, the classification of toners, commonly used herbal ingredients and excipients, methods of formulation, and the physicochemical, microbiological, safety and stability parameters used to evaluate herbal facial toners. Regulatory aspects, current challenges and future perspectives are also discussed. The review is intended to serve as a reference for researchers and students involved in the development of safe, stable and effective herbal cosmetic products.*

Keywords: herbal facial toner; cosmetics; plant extract; formulation; evaluation; skin pH; stability

I. INTRODUCTION

Skin care routines are generally built around cleansing, toning, moisturising and sun protection. Within this sequence, the toner (also called a skin tonic, astringent or freshener) is a thin liquid intended to remove traces of dirt, oil and cleanser, to temporarily tighten the appearance of pores, and to rebalance skin pH after washing [1,2]. Because most soaps and many cleansers are alkaline, washing can raise the pH of the skin surface, whereas healthy skin is naturally acidic, with a mean surface pH below 5 [3].

Herbal cosmetics have a long history in traditional systems of medicine such as Ayurveda, Unani and Siddha, where rose water, sandalwood, turmeric, aloe and neem have been used for cleansing and skin conditioning. Phytoconstituents including flavonoids, polyphenols, tannins, essential oils, mucilage and saponins have antioxidant, anti-inflammatory, astringent and antimicrobial properties relevant to skin care [4,5]. Consumers also tend to regard herbal products as milder and safer, which has driven market growth. However, "natural" does not mean risk-free; plant materials vary in composition, may be contaminated microbially, and can cause allergic reactions. A systematic approach to formulation and evaluation is therefore essential.

This review discusses the formulation considerations and evaluation methods for herbal facial toners with emphasis on ingredient selection, preparation techniques, quality control and safety assessment.

1.1 Skin Physiology and Rationale for Toner Use

The outermost layer of the skin, the stratum corneum, acts as the main barrier against water loss and external insults. It is covered by an acid mantle, a film of sebum, sweat and natural moisturising factors with a pH of roughly 4.5–5.5. This acidity supports barrier enzyme activity and limits the growth of pathogenic microorganisms [3]. Cleansing, hard water, environmental pollution and over-use of alkaline products can disturb the acid mantle, leading to dryness, irritation or breakouts.

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www.ijarsct.co.in
DOI: 10.48175/IJARSCT-40442

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A well-designed toner contributes in several ways: (i) removing residual cleanser and surface debris, (ii) restoring skin pH, (iii) delivering humectants and plant actives, (iv) providing a mild astringent or soothing effect, and (v) improving the absorption of later serums and moisturisers [2,6].

II. CLASSIFICATION OF FACIAL TONERS

Toners are commonly grouped by alcohol content and by intended skin type (Table 1).

Type	Typical features	Suitable skin type
Fresheners / hydrating toners	Alcohol-free or very low alcohol; rich in humectants and floral waters	Dry, sensitive and mature skin
Skin toners / tonics	Low alcohol; mild astringents and plant extracts	Normal and combination skin
Astringents	Higher alcohol or strongly astringent extracts (e.g., witch hazel)	Oily and acne-prone skin
Exfoliating toners	Contain hydroxy acids or enzymes	Dull or congested skin (use with caution)

Table 1. Classification of facial toners

III. HERBAL INGREDIENTS USED IN FACIAL TONERS

Herbal actives may be incorporated as aqueous or hydroalcoholic extracts, hydrosols (distilled floral waters), glycerites or essential oils. Selection depends on the skin concern targeted and on the safety and stability of the extract. Commonly reported ingredients are summarised in Table 2 [2,4,5,7].

Ingredient	Botanical source	Reported functions in toners
Rose water	Rosa damascena	Mild astringent, soothing, fragrance, skin conditioning
Aloe vera gel/juice	Aloe barbadensis Miller	Moisturising, soothing, wound-healing and anti-inflammatory support [8]
Green tea extract	Camellia sinensis	Antioxidant (catechins), anti-inflammatory, mild astringent
Cucumber extract	Cucumis sativus	Cooling, hydrating, mild astringent
Witch hazel	Hamamelis virginiana	Tannin-rich astringent, pore-tightening effect
Neem extract	Azadirachta indica	Antibacterial and anti-acne activity
Chamomile	Matricaria chamomilla	Soothing, anti-irritant
Tulsi (holy basil)	Ocimum sanctum	Antimicrobial, antioxidant
Lemon / citrus	Citrus limon	Vitamin C source, mild astringent; may cause photosensitivity
Turmeric / sandalwood	Curcuma longa / Santalum album	Antioxidant, brightening and soothing actions

Table 2. Common herbal ingredients and their reported functions.

Plant extracts rich in polyphenols have been shown to inhibit collagenase and elastase and to exhibit antioxidant activity in vitro, which supports their use in products aimed at skin protection [9].

IV. EXCIPIENTS AND ADDITIVES

In addition to herbal actives, a toner requires functional excipients to give a clear, stable, elegant and microbiologically safe product:

- Vehicle: purified or distilled water, with or without a small amount of ethanol or propylene glycol as cosolvent.
- Humectants: glycerine, propylene glycol, sorbitol, hyaluronic acid or panthenol to retain moisture [10].
- Preservatives: phenoxyethanol, sodium benzoate, potassium sorbate, parabens (where permitted) or other approved systems; essential for water-rich herbal formulations.

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- Solubilizers: polysorbate 20/80 or PEG-40 hydrogenated castor oil to disperse essential oils and fragrance in water.
- pH adjusters and buffers: citric acid, lactic acid or sodium citrate to maintain a skin-compatible pH.
- Chelating agent and antioxidant: disodium EDTA and tocopherol or ascorbic acid to improve stability.
- Colour and fragrance: permitted natural colourants and essential oils, kept to the minimum necessary.

V. METHODS OF FORMULATION

5.1 Collection and authentication of plant material

Plant parts are collected, authenticated by a botanist or pharmacognosist, washed, shade-dried and powdered. Pharmacognostic standardisation (macroscopic and microscopic characters, foreign matter, ash values, extractive values and moisture content) should be performed in accordance with the Indian Pharmacopoeia or other recognised standards [7,11].

5.2 Preparation of extracts

Common extraction techniques include maceration, infusion, decoction, percolation and Soxhlet extraction, using water or hydroalcoholic solvent. For fresh materials such as aloe or cucumber, juice or gel is expressed and filtered. Solvent choice affects the profile of extracted phytoconstituents and residual solvent levels; water and ethanol are preferred for cosmetic use.

5.3 Preparation of the toner

A typical laboratory procedure is outlined below:

- Dissolve the humectant (e.g., glycerine) and any water-soluble additives in part of the purified water.
- Add the filtered herbal extract(s), hydrosol or juice with continuous stirring.
- Separately mix the essential oil or fragrance with the solubilizer and add to the aqueous phase slowly.
- Add the preservative system and chelating agent; stir until a clear solution is obtained.
- Adjust the pH to about 4.5–5.5 using citric acid or an appropriate buffer.
- Make up to volume with purified water, filter through muslin or a suitable filter, and fill into clean, labelled, airtight bottles, preferably amber or opaque and fitted with a spray pump or dropper.

VI. EVALUATION OF HERBAL FACIAL TONER

Evaluation confirms that each batch is safe, effective and consistent. Parameters are usually classified as organoleptic, physicochemical, microbiological, safety-related and stability-related (Table 3) [2,6,12].

Table 3. Evaluation parameters for herbal facial toner.

Parameter	Method / principle	Typical expectation
Appearance, colour, odour	Visual and sensory inspection	Clear to slightly coloured, uniform, pleasant odour
pH	Calibrated digital pH meter at room temperature	Approx. 4.5–5.5, compatible with skin
Viscosity	Brookfield viscometer or Ostwald viscometer	Low viscosity, free-flowing
Specific gravity	Specific gravity bottle / pycnometer	Close to that of water; reproducible between batches
Spreadability / sprayability	Visual observation of spray pattern and wetting	Even, fine and easy application
Clarity and particulate	Visual examination against black and	Free from visible particles or

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matter	white background	turbidity
Total solids	Evaporation of a known volume to constant weight	Consistent between batches
Foaming / surface tension	Shake test; stalagmometer	Minimal foam
Microbial limit test	Total aerobic count, yeast and mould count, absence of specified pathogens	Within pharmacopoeia or BIS limits
Preservative efficacy	Challenge test with representative organisms	Meets acceptance criteria
Skin irritation / patch test	Closed or open patch test on human volunteers or in vitro methods	No erythema, oedema or itching
Stability	Storage at 4 °C, room temperature and 40 °C/75% RH; freeze–thaw cycles	No change in colour, odour, clarity, pH

6.1 Safety and irritation studies

Safety evaluation is crucial for leave-on facial products. Classical animal studies using the Draize scoring scheme [13] are increasingly replaced by in vitro reconstructed human epidermis models (e.g., OECD Test Guideline 439) and by human patch testing under ethical approval and informed consent [14]. Volunteers with known allergies or skin disease should be excluded, and results are recorded as irritation scores or primary irritation indices.

6.2 Stability studies

Stability testing assesses whether the toner retains its physical, chemical and microbiological characteristics throughout its intended shelf life. Samples are stored in the final packaging under different temperature and humidity conditions and examined at defined intervals (e.g., 0, 1, 2 and 3 months) for appearance, pH, viscosity, clarity and microbial growth. Photostability is important because many plant pigments and essential oils are light sensitive.

6.3 Efficacy evaluation

Beyond quality control, claims such as hydration, oil control or pore refinement may be supported by instrumental measures like corneometry (skin hydration), sebumetry (sebum), and trans epidermal water loss, as well as volunteer questionnaires and dermatological assessment [2,10]. In vitro antioxidant (DPPH) and antimicrobial (agar diffusion) assays are also frequently used to support the biological activity of herbal ingredients.

VII. REGULATORY CONSIDERATIONS

In India, cosmetics are regulated under the Drugs and Cosmetics Act, 1940 and the Cosmetics Rules, 2020, which set requirements for manufacture, labelling, import and safety, and refer to Bureau of Indian Standards specifications for ingredients and test methods [15]. Labels should list ingredients, batch number, manufacturing and expiry dates, net content and manufacturer details. Products must not make drug-like therapeutic claims. International markets follow their own frameworks (for example, EU Regulation 1223/2009), which require a cosmetic product safety assessment and a Product Information File.

VIII. CHALLENGES AND FUTURE PERSPECTIVES

- Variability of plant material due to geographical origin, harvest time and storage, which demands standardisation using marker compounds.
- Microbial contamination and limited preservative options for products marketed as “natural”.
- Colour, odour and clarity changes caused by oxidation of polyphenols and volatile oils.
- Allergenic potential of essential oils and some botanical extracts.
- Scarcity of robust, controlled clinical studies supporting efficacy claims.

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Future work may involve nanocarriers and phytosomes for improved delivery of botanical actives, green extraction technologies, standardised extracts with validated HPLC/HPTLC fingerprints, microbiome-friendly formulations, and wider adoption of non-animal safety testing.

IX. CONCLUSION

Herbal facial toners offer a gentle, plant-based alternative to conventional alcohol-rich products by combining cleansing support, pH restoration, hydration and the antioxidant and soothing properties of botanical actives. Successful development depends on authenticated and standardised plant material, a compatible excipient system, an appropriate preservative strategy, and thorough evaluation of physicochemical properties, microbial quality, safety and stability. Continued research with standardised extracts and well-designed clinical studies will strengthen the evidence base and support the development of safe and effective herbal toners.

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