



Review Article

Ocimum Sanctum (Tulsi) Leaves and Herbal Syrup: A Review of Pharmacognostic And Phytochemical Evaluation and Formulation

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Tulsi (*Ocimum sanctum* L., Lamiaceae) is a sacred and widely used medicinal herb of India, and its leaves are traditionally given for cough, bronchitis and fever. A syrup is a concentrated sugar solution containing the extract of the drug, and herbal syrups are popular for cough and respiratory complaints. The quality of a herbal syrup depends first of all on the quality of the leaf from which it is made, so the leaf must be authenticated and standardised. This review describes the pharmacognostic and phytochemical evaluation of tulsi leaves, which covers macroscopy, powder microscopy, loss on drying, ash and extractive values, phytochemical screening and thin layer chromatography, and the formulation of a herbal syrup by the decoction and sucrose method at three leaf strengths. It also describes the tests used for evaluating a syrup, namely organoleptic properties, pH, specific gravity, viscosity, sedimentation, total solids, microbial load and stability. Six published studies on tulsi standardisation, phytochemistry and tulsi-containing syrups are discussed. The reported syrups are mostly polyherbal, and the raw leaf and the finished syrup are seldom evaluated together; this gap is noted.

Keywords: *Ocimum sanctum*, Tulsi, Herbal syrup, Standardisation, Phytochemical screening, Pharmacognosy, Evaluation.

INTRODUCTION

Herbal medicines are therapeutic products obtained from plants, and they form the basis of traditional systems such as Ayurveda. They are widely used because they are easily available, relatively inexpensive and generally well tolerated. Plant drugs are given in many forms, and for liquid oral use the common forms are decoctions (kwatha), infusions, syrups and fermented preparations. A syrup is a concentrated aqueous solution of sugar, usually sucrose, to which the extract of the drug and suitable additives are added. [1] Tulsi (*Ocimum sanctum* L., family Lamiaceae; also called holy basil) is a sacred and widely used medicinal herb of India. Its leaves,

seeds and roots are used in Ayurvedic medicine, and the leaves are traditionally given for cough, bronchitis, fever and other conditions; eugenol and ursolic acid are among its best-known constituents, and antioxidant, anti-inflammatory, antimicrobial and antidiabetic activities have been reported.[2] Because the quality of a herbal syrup depends first of all on the quality of the leaf from which it is made, the leaves must be authenticated and standardised before they are used.[3,4] Herbal syrups are popular for cough and respiratory complaints, and several tulsi-containing syrups have been formulated and evaluated. [5,6,7] The common forms of liquid oral herbal preparations are compared below.

Table: Liquid Oral Herbal Dosage Forms [1,3,8]

Dosage form	Description	Remarks
Syrup	Concentrated aqueous sugar solution containing the extract and additives	Palatable; sugar acts as a vehicle and a preservative
Kwatha (decoction)	Prepared by boiling the coarse drug powder in water	Prepared fresh; spoils quickly
Swarasa (juice)	Juice pressed from fresh leaves	Prepared fresh; very short life
Asava / Arishta	Fermented liquid preparations	Contain self-generated alcohol
Mother tincture	Alcoholic extract of the drug	Contains alcohol; strong taste

Herbal materials are natural products, so their composition changes with the species, the part used, the place and time of collection, drying and storage. Adulteration with other *Ocimum* species or other leaves, microbial contamination and pesticide residues can also affect the quality. For this reason the WHO has published methods for the quality control of herbal materials, and the Indian Pharmacopoeia

and the Ayurvedic Formulary give standards and methods of preparation. [4,8,9]

***Ocimum sanctum* (Tulsi) Leaves**

The leaves of *Ocimum sanctum* are the drug used for pharmacognostic and phytochemical evaluation and as the active ingredient of herbal syrups. Its botanical details and main constituents are given below.

Table: Profile of *Ocimum sanctum* Leaves [2,10]

Item	Details
Botanical name and family	<i>Ocimum sanctum</i> L. (syn. <i>Ocimum tenuiflorum</i>), Lamiaceae
Common and Ayurvedic names	Tulsi, holy basil; Tulasi
Part used	Dried leaves (also fresh leaves in traditional use)
Major constituents reported	Volatile oil rich in eugenol; ursolic acid; flavonoids, alkaloids, terpenoids, tannins and saponins
Traditional use	Cough, bronchitis, fever, skin diseases, as an immunity booster

A phytochemical and GC-MS study of the hydro-ethanolic leaf extract of *Ocimum sanctum* detected flavonoids, alkaloids and terpenoids and identified 40 compounds, with eugenol among the major ones.[10] The leaf has also been standardised for moisture content, total ash, water-soluble and acid-insoluble ash values, and the standardisation is considered useful for authenticating the genuine drug.[3]

Herbal Syrup as a Dosage Form

A syrup is a pleasant, viscous liquid dosage form that contains the extract of the drug dissolved in a concentrated sugar solution. Sucrose gives the sweetness and the viscosity and also helps to preserve the product, while the other additives (glycerin, a preservative and an acid) improve the stability and the taste.[1] A good herbal syrup should be clear and uniform, have a pleasant taste and odour, have a pH and a specific gravity within the usual limits, show no crystallisation or sedimentation, be free of microbial growth, and remain stable on storage.[1,6,7]

Table: Components of a Herbal Syrup [1,6]

Component	Role	Examples
Extract	Provides the therapeutic effect	Aqueous decoction of tulsi leaves
Sweetener and vehicle	Sweetness, viscosity, preservation	Sucrose; honey
Co-solvent / stabiliser	Prevents crystallisation, improves clarity	Glycerin
Preservative	Prevents microbial growth	Sodium benzoate, methyl paraben
Acidifier	Adjusts pH, improves stability	Citric acid

Syrups can be prepared by the methods below. Preparation of a decoction followed by dissolving the sucrose in the hot filtrate follows the traditional method of preparing a kwatha and uses common

laboratory equipment. The quality of the syrup depends on the strength of the extract, on the concentration of sucrose (a very high concentration crystallises on storage and a low one allows microbial growth), on the pH and on the preservative system. [1]

Table: Methods of Preparing Syrups [1]

Method	Principle	Remarks
Solution with heat	Sugar dissolved in the hot extract or water	Fast; suitable for stable extracts
Solution by agitation without heat	Sugar dissolved in the cold extract by stirring	Slow; protects heat-sensitive constituents
Addition of extract to simple syrup	Prepared extract mixed with ready simple syrup	Easy to control the strength
Percolation	Extract is passed through the bed of sugar	Special apparatus needed

Advantages and Limitations

Table: Advantages and Limitations of Herbal Syrup [1,3,6]

Advantages	Limitations
Pleasant taste, which masks the pungent taste of the herb, and easy administration to children and elderly patients	Sugar content makes the syrup unsuitable for diabetic patients unless a sugar-free base is used
Liquid form gives quick onset of action and easy adjustment of the dose	Aqueous preparations are liable to microbial growth, so a preservative is necessary
Sucrose and glycerin act as a vehicle and help to preserve the preparation	Constituents such as eugenol and other volatile compounds may be lost during heating
Simple, low-cost method of preparation based on the traditional decoction	Bulky and heavier to carry than solid dosage forms; the dose depends on measuring spoons
Standardised syrup is more reliable than a freshly prepared decoction, which spoils quickly	Quality varies with the source of the leaves and the method of extraction

Applications

- Relief of cough, cold and bronchitis, as in the traditional use of tulsi.[2,5]
- General immunity booster and antioxidant supplement. [2]
- Base for polyherbal syrups, for example with ginger, turmeric, giloy or honey. [6,7]
- Pleasant vehicle for other herbal extracts in paediatric use.

Traditional and Standardised Tulsi Preparations

Many herbal syrups in the market are not standardised: the quantity of the herb, the extraction method and the quality of the leaf are often not stated. Pharmacopoeial standards for the raw drug and for herbal syrups are limited, so the leaf and the syrup have to be standardised separately. [3,4,9] The two kinds of preparation are compared below.

Table: Comparison of Traditional or Marketed Preparation and Standardised Syrup [3,4,9,11]

Feature	Traditional / marketed preparation	Standardised syrup
Raw material	Often not authenticated	Authenticated and standardised leaves
Preparation	Fresh decoction or unspecified method	Defined decoction and syrup method

Preservation	Short life or unknown	Preservative and sugar base
Quality control	Often none	Physical, phytochemical and microbial limits
Documentation	Limited	Batch record and TLC fingerprint
Stability	Unknown	Studied as per ICH guidelines

LITERATURE REVIEW

The studies below deal with the standardisation of tulsi and with the formulation and evaluation of herbal syrups.

Standardisation and Phytochemistry of Tulsi

Debbarma et al. standardised *Ocimum sanctum*, a herb used for bronchitis, malaria and skin illnesses. The raw drug was evaluated for moisture content, total ash, water-soluble ash and acid-insoluble ash, and an in-house mother tincture was standardised for total solids, pH, TLC, UV-visible spectra, weight per volume and alcohol content. The authors concluded that such standardisation is useful for authenticating the genuine drug. [3]

Joshi reviewed the phytoconstituents and the traditional, medicinal and bioactive uses of tulsi. The review notes that the chemical composition of tulsi is complex, that eugenol and ursolic acid are among the best-known compounds, and that standardisation has been difficult. Antioxidant, anti-inflammatory, antimicrobial, antidiabetic and antimalarial effects are described, and Ayurvedic practitioners use tulsi for anxiety, chronic cough, bronchitis and fever. [2]

Srivastava et al. prepared a 70% ethanol extract from the dried leaves of *Ocimum sanctum* and screened it for phytochemicals, and then analysed the extract by GC-MS. Flavonoids, alkaloids and terpenoids were detected, and GC-MS identified 40 compounds, with eugenol among the major ones. [10]

Herbal Syrups Containing Tulsi

Devkar et al. developed a herbal cough syrup using pudina, tulsi or cinnamon as the main ingredient with honey. The syrup was prepared at laboratory scale and evaluated for pH, viscosity, density and stability, and the authors reported that it was stable and that its antitussive activity at the lowest tested dose was better than that of the standard drug. [5]

Kumar and Anamika developed a polyherbal syrup for respiratory health from six indigenous plants, prepared as aqueous decoctions and combined with a sucrose-based simple syrup. The syrup was clear and dark brown with a pleasant aroma, its pH, specific gravity and viscosity were within the pharmacopoeial ranges, and alkaloids, flavonoids, tannins, saponins, phenolics, glycosides and essential oils were detected. The syrup was reported to be homogeneous and stable under the test conditions, and further in-vitro, stability, animal and clinical studies were recommended. [6]

Shendage et al. formulated a cough syrup with *Tinospora cordifolia* as the main ingredient together with tulsi, ginger, turmeric and honey, using methyl paraben as the preservative and water as the vehicle. The syrup was evaluated for appearance, colour, odour, taste, pH, viscosity, density, specific gravity, clarity, sedimentation and stability. It showed acceptable sensory properties, suitable pH and viscosity, good clarity and satisfactory physical stability, and the authors stated that pharmacological and clinical studies are needed. [7]

Table: Summary of the Studies Reviewed [2,3,5,6,7,10]

Subject	Study	Type of work	Main points examined
Tulsi raw drug and tincture	Debbarma 2024	Standardisation	Moisture, ash values, pH, TLC, UV
Tulsi	Joshi 2017	Review	Constituents, traditional and bioactive uses
Tulsi leaf extract	Srivastava 2021	Phytochemical and GC-MS analysis	Phytochemical groups, 40 compounds

Herbal cough syrup	Devkar 2021	Formulation and evaluation	pH, viscosity, density, stability, activity
Polyherbal respiratory syrup	Kumar 2026	Formulation and evaluation	Physicochemical, phytochemical, stability
Giloy-tulsi cough syrup	Shendage 2026	Formulation and evaluation	Organoleptic, pH, viscosity, sedimentation, stability

Observations from the Literature

Three points follow from the studies. First, tulsi leaf is standardised by its moisture content, ash values and phytochemical profile, and eugenol and flavonoids are its reported constituents. [2,3,10] Second, herbal

syrups containing tulsi are evaluated by organoleptic properties, pH, density or specific gravity, viscosity, clarity, sedimentation and stability. [5,6,7] Third, the syrups reported so far are polyherbal or cough-specific, and the raw drug and the syrup are not usually evaluated together.

Table: Parameters Used in the Studies Reviewed [3,5,6,7,10]

Parameter	Studies in which it was used
Moisture content and ash values of the raw drug	Debbarma
Phytochemical screening	Srivastava, Kumar
TLC / GC-MS profile	Debbarma, Srivastava
Organoleptic properties of the syrup	Kumar, Shendage
pH, density / specific gravity	Devkar, Kumar, Shendage
Viscosity	Devkar, Kumar, Shendage
Clarity and sedimentation	Shendage
Stability	Devkar, Kumar, Shendage

Gap in the Literature

The reported studies either standardise the tulsi drug or its tincture, or formulate polyherbal syrups in which tulsi is one of several ingredients, but they do not evaluate the pharmacognostic and phytochemical quality of the tulsi leaf and then use the same leaf to prepare a syrup, study the effect of the extract strength on the quality of the syrup, and compare it with a marketed syrup.

Pharmacognostic Evaluation of Tulsi Leaves

Collection and Authentication

Fresh, mature leaves of tulsi are collected from healthy plants, preferably in the morning, and the identity of the plant is confirmed by a qualified botanist or the Department of Pharmacognosy. The identity is confirmed by the macroscopic characters of the leaf (shape, size, margin, venation, colour, odour and taste) and by powder microscopy, and a voucher

specimen is kept. The leaf of *Ocimum sanctum* is aromatic and ovate to elliptical with a petiole, and as a member of the Lamiaceae it shows stomata and glandular and non-glandular trichomes in microscopy. [2,3] Leaves that are yellow, diseased, insect-infested or mixed with other *Ocimum* species or foreign matter are rejected.

Drying, Size Reduction and Sieving

The leaves are washed with water to remove dust, dried in shade (or in a hot air oven at not more than 50 °C so that the volatile oil is not lost), and powdered in an electric grinder using short intervals. The powder is passed through sieve no. 85[8] and stored in airtight containers away from light and moisture. For the preparation of the decoction, a coarse powder may be used instead of the fine powder.

Pharmacognostic and Physicochemical Standardisation

Table: Standardisation Parameters of the Leaf [3,4,9,12]

Study	Method
Organoleptic and macroscopic characters	Shape, size, colour, odour, taste and texture noted visually
Powder microscopy	Powder mounted in chloral hydrate and observed for stomata, trichomes and other cells
Foreign organic matter	Weighed sample spread and foreign matter separated; percentage calculated
Loss on drying (moisture)	2 g dried at 105 °C to constant weight
Total ash, acid-insoluble ash and water-soluble ash	Incinerated at about 450 °C; ash boiled with dilute hydrochloric acid or with water
Water-soluble and alcohol-soluble extractive values	5 g macerated with 100 mL water or ethanol for 24 h, filtered, aliquot evaporated and weighed

These tests are carried out on the leaf before it is used for the syrup, so that only material that complies with

the limits of the Indian Pharmacopoeia and the WHO guidelines is accepted. [4,9]

Phytochemical Screening and TLC

Table: Preliminary Phytochemical Tests [10,12]

Constituent	Test	Positive result
Alkaloids	Mayer's and Dragendorff's tests	Cream and orange-red precipitate
Flavonoids	Shinoda test (magnesium and hydrochloric acid)	Pink to red colour
Tannins and phenols	Ferric chloride test	Blue-black or green colour
Saponins	Foam test	Persistent foam
Glycosides	Keller–Killiani test	Brown ring at the junction
Carbohydrates	Molisch's test	Violet ring at the junction
Volatile oil	Filter paper test	Oily spot that disappears on warming

For TLC fingerprinting, a methanolic extract of the leaf is spotted on silica gel G plates, developed in toluene: ethyl acetate (93: 7), sprayed with vanillin–sulphuric acid reagent and heated, and the R_f values of the spots are noted.[3,12]

Formulation of Herbal Syrup

Materials Used

Table: Materials Commonly Used for a Tulsi Syrup [1,6,7]

No.	Material	Role / use
1	Tulsi leaves (<i>Ocimum sanctum</i>)	Drug; source of the extract
2	Sucrose	Sweetener and vehicle of the syrup
3	Glycerin	Co-solvent and stabiliser
4	Sodium benzoate or methyl paraben	Preservative
5	Citric acid	Acidifier
6	Purified water	Vehicle

Formulation

A typical formulation for a batch of 100 mL, with the decoction made at three leaf strengths, is shown

below; the proportions are indicative and are adjusted after preliminary trials. [1,5]

Table: Typical Formulation of Tulsi Syrup (per 100 mL) [1,5]

Ingredient	F1	F2	F3	Function
Tulsi leaf (g, as decoction)	10	15	20	Active ingredient
Sucrose (g)	66	66	66	Sweetener, vehicle
Glycerin (mL)	5	5	5	Co-solvent
Sodium benzoate (g)	0.1	0.1	0.1	Preservative
Citric acid (g)	q.s.	q.s.	q.s.	pH adjustment
Purified water	to 100 mL	to 100 mL	to 100 mL	Vehicle

Method of Preparation

1. The weighed quantity of the tulsi leaf (coarse powder) is boiled with water for about 15 minutes in a covered vessel and cooled.
2. The decoction is strained and filtered through a muslin cloth and then through filter paper, and the volume is adjusted with hot water.
3. Sucrose is dissolved in the hot filtrate by gentle heating and stirring, and the solution is cooled.
4. Glycerin, sodium benzoate (dissolved in a little water) and citric acid are added with stirring, and

the volume is made up to 100 mL with purified water.

5. The syrup is filled into clean, dry, amber coloured bottles, sealed and labelled with the batch number and date.

Evaluation of Herbal Syrup

Herbal syrups are evaluated for their physical, phytochemical and microbial quality and for stability. The usual tests and their methods are given below. [5,6,7,9]

Table: Evaluation Parameters of Herbal Syrup [5,6,7,9,11]

Parameter	Method
Organoleptic evaluation	Colour, odour, taste and clarity noted
pH	pH of the syrup measured directly with a calibrated pH meter
Specific gravity and density	Measured with a specific gravity bottle at room temperature
Viscosity	Measured with a viscometer at room temperature
Sedimentation and total solids	Syrup kept undisturbed in a measuring cylinder; 5 mL dried to constant weight
Phytochemical screening and TLC	Same tests as the leaf extract; TLC compared with the leaf extract
Microbial load	Total bacterial, yeast and mould counts by the plate method
Stability study	Stored at $25 \pm 2^\circ\text{C}$ / $60 \pm 5\%$ RH and $40 \pm 2^\circ\text{C}$ / $75 \pm 5\%$ RH for one month; colour, pH, sedimentation, viscosity and microbial count checked at 0, 15 and 30 days

Calculations

Table: Formulae Used in the Evaluation [4,9]

Parameter	Formula
Loss on drying (%)	$[(\text{Initial weight} - \text{final weight}) / \text{initial weight}] \times 100$
Total ash (% w/w)	$(\text{Weight of ash} / \text{weight of sample}) \times 100$
Extractive value (% w/w)	$(\text{Weight of dried extract} \times \text{dilution factor} / \text{weight of sample}) \times 100$
Specific gravity	$\text{Weight of syrup in the bottle} / \text{weight of an equal volume of water}$
Density (g/mL)	$\text{Weight of syrup} / \text{volume of syrup}$

Viscosity (cP)	Reading of the viscometer at the stated spindle and speed
Total solids (% w/v)	(Weight of residue after drying 5 mL / 5) × 100
Sedimentation (%)	(Volume of sediment / total volume of syrup) × 100
Rf value	Distance moved by the spot / distance moved by the solvent front

Quality Expected of a Herbal Syrup

Table: Observations Reported for Tulsi-containing Syrups [5,6,7]

Parameter	Reported observation	Studies
Appearance	Clear, brownish liquid without suspended matter	Kumar, Shendage
Odour and taste	Characteristic aromatic odour, sweet taste	Kumar, Shendage
pH	Slightly acidic to near neutral	Devkar, Kumar, Shendage
Specific gravity	Greater than 1 (sugar syrup)	Kumar, Shendage
Sedimentation and crystallisation	Absent on storage	Shendage
Microbial growth	Absent	Kumar

CONCLUSION

Tulsi is a widely used medicinal herb for cough and respiratory complaints, and the quality of a herbal syrup depends on the quality of the leaf used. The studies reviewed show that tulsi leaf can be standardised by its macroscopic and microscopic characters, moisture content, ash and extractive values, phytochemical screening and TLC, and that herbal syrups containing tulsi can be prepared by the decoction and sucrose method and evaluated for appearance, pH, specific gravity, viscosity, sedimentation, microbial load and stability. The reported syrups are mostly polyherbal, and the raw leaf and the finished syrup are seldom evaluated together. Most of the work reviewed is laboratory based and does not include clinical or animal studies, so the antitussive or other therapeutic effect of the syrup is not confirmed. Further work may include assay of eugenol or ursolic acid by HPTLC or HPLC, sugar-free syrups for diabetic patients, and studies of activity.

REFERENCES

- Lachman L, Lieberman HA, Kanig JL, editors. The Theory and Practice of Industrial Pharmacy. 3rd ed. Philadelphia: Lea & Febiger; 1986.
- Joshi RK. Phytoconstituents, traditional, medicinal and bioactive uses of Tulsi (*Ocimum sanctum* Linn.): a review. J Pharmacogn Phytochem. 2017;6(2):261-264.
- Debbarma P, Mishra AK, Mandloi B. Standardisation of *Ocimum sanctum*. J Pharmacogn Phytochem. 2024;13(2):237-239. doi: 10.22271/phyto.2024.v13.i2c.14885.
- World Health Organization. Quality Control Methods for Herbal Materials. Geneva: WHO; 2011.
- Devkar MJ, Shaikh SSM, Jadhao AG, Sanap J, Patil PA. Formulation and evaluation of herbal syrup. Asian J Pharm Res Dev. 2021;9(3):16-22. doi:10.22270/ajprd.v9i3.955.
- Kumar M, Anamika. A comprehensive pharmaceutical approach to developing a polyherbal syrup for respiratory wellness from indigenous plants. J Pharmacogn Phytochem. 2026;15(3):741-745. doi: 10.22271/phyto.2026.v15.i3f.15941.
- Shendage VS, Gange JN, Purane AK, Pawar SH, Masal SS, Panasare VJ, Kopnar VP, Khedkar AN. Formulation and evaluation of *Tinospora cordifolia* cough syrup containing gulvel, tulsi, turmeric, honey and ginger. The Bioscan. 2026;21(2):1255-1263. doi:10.63001/tbs.2026.v21.i02.pp1255-1263.
- Ministry of Health and Family Welfare, Government of India. The Ayurvedic Formulary of India, Part I. New Delhi.
- Indian Pharmacopoeia Commission. Indian Pharmacopoeia 2022. Ghaziabad: IPC; 2022.

10. Srivastava A, Subhashini, Keshari AK, Srivastava R. Phytochemical and GC-MS analysis of hydro ethanolic leaf extract of *Ocimum sanctum* (L.). *Pharmacogn Res.* 2021;13(4):233-237. doi:10.5530/pres.13.4.16.
11. International Council for Harmonisation. ICH Q1A(R2): Stability Testing of New Drug Substances and Products. 2003.
12. Khandelwal KR, Sethi V. *Practical Pharmacognosy: Techniques and Experiments*. Pune: Nirali Prakashan.

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