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A PHARMACEUTICAL AND ANALYTICAL STUDY OF KULATHAGUDA

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ABSTRACT

Kulathaguda is a classical Avaleha formulation mentioned in Chakradatta under Hikka-Śvāsa Adhikara, indicated in Kasa (cough), Śvāsa (especially Tamaka Śvāsa/bronchial asthma), Jvara (fever) and Hikka (hiccup). The study aimed to standardize its pharmaceutical preparation and to establish comprehensive analytical parameters in accordance with contemporary quality control norms. Kulathaguda was prepared through classical Avaleha Pāka processes and evaluated for organoleptic features, physico-chemical constants, phytochemical profile, chromatographic pattern, sugar content and microbial load. The findings showed a stable semi-solid brownish-black Avaleha with characteristic sensory attributes, acceptable physico-chemical values, rich sugar and phytoconstituent content and microbial counts within pharmacopoeial limits, supporting its safety, stability and suitability for clinical use.

KEYWORDS: *Kulathaguda, Avaleha Kalpana, Tamaka Swasa, Pharmaceutical and analytical study, Ayurveda*

INTRODUCTION

Ayurveda, the science of life, approaches health as a dynamic balance of doṣa, dhātu and mala and gives equal importance to ahara, vihara and aushadha in disease management. Bhaishajya Kalpana evolved to transform raw natural substances into pharmaceutically refined dosage forms that are safe, stable and therapeutically potent, minimizing drawbacks of crude drug use.

Avaleha Kalpana offers advantages like longer shelf life, better palatability, flexible dosing and suitability across age groups, making it a preferred form in chronic respiratory disorders.

Kulathaguda, described in Chakradatta (Hikka-Śvāsa Adhikara 12/31–34), is prepared from Kulatha, Daśamūla, Bharangī, jaggery, honey and aromatic Prakṣepa Dravya like Twak, Ela, Patra and pippali, reflecting a rational poly-herbal design for Kasa, Śvāsa, Jvara and Hikka. However, its wider clinical and regulatory acceptance demands clearly defined pharmaceutical procedures and reproducible analytical standards, which this study attempts to provide.

AIMS AND OBJECTIVES

1. Preparation of *Kulathaguda* strictly adhering to classical *Chakradatta* references and *Avaleha Pāka Vidhi*.
2. Comprehensive pharmaceutical documentation including detailed procedure, observations, yield calculations, and precautions.
3. Analytical profile establishing preliminary pharmacopeial quality standards for identity, purity, strength, and safety.

MATERIALS AND METHODS

Pharmaceutical source: All raw drugs were procured from the local Ayurvedic drug market and authenticated by experts from the Department of Dravyaguna and Rasashastra, ensuring genuineness and quality. Pharmaceutical work was carried out in the Mini Pharmacy Unit, PG Department of RS & BK, Gopabandhu Ayurveda Mahavidyalaya, Puri.

Analytical source: Analytical testing was Performed at Quality Control Laboratories, ALN Rao Memorial Ayurvedic Medical College and PG Centre, Koppa, Chikkmagaluru, Karnataka, utilizing calibrated instruments and analytical-grade reagents.

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Table 1: List of ingredients of Kulathaguda.

Sl.No.	Category	Sanskrit Name	Botanical Name	Family	Part Used	Parts Ratio	Quantity
1	Kwātha Dravya	Kulathā	Dolichos biflorus	Fabaceae	Seed (Bīja)	10	2.5 kg
2	Kwātha Dravya	Daśamūla	Classical 10 roots	-	Roots	10	2.5 kg
3	Kwātha Dravya	Bharangī	Clerodendrum serratum	Verbenaceae	Stem bark	10	2.5 kg
4	Madhura Dravya	Gudā				6	1.25 kg
5	Prakṣepa Dravya	Vaṃśalocana	Bambusa arundinacea	Poaceae	Inner secretion	4	150 g
6	Prakṣepa Dravya	Pippalī	Piper longum	Piperaceae	Fruit	3	140 g
7	Prakṣepa Dravya	Tvak	Cinnamomum zeylanicum	Lauraceae	Bark	1	46 g
8	Prakṣepa Dravya	Elā	Elettaria cardamomum	Zingiberaceae	Seed	1	46 g
9	Prakṣepa Dravya	Patra	Cinnamomum tamala	Lauraceae	Leaf	1	46 g
10	Additive	Madhu		-	Natural product	3.5	200 g

INGREDIENTS OF KULATHAGUDA

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Preparation of Kwatha

Yavakūta (coarse powder) of Kulatha, Daśamūla and Bharangī (total 7.5 kg) was prepared by traditional pounding and sieving to achieve uniform particle size suitable for decoction. The coarsely powdered drugs were soaked overnight in 19 litres of potable water to enhance initial extraction, and then boiled on mild flame with intermittent stirring until reduced to one-fourth (approximately 5 litres). The hot decoction was immediately filtered through a clean cotton cloth, yielding a dark brown

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Kwatha with kaṣāya-tikta taste, clear appearance and characteristic herbal aroma.

Observations

- Color: Dark brown with characteristic herbal hue
- Taste: *Kaṣāya-Tikta* (astringent-bitter) consistent with component drugs
- Smell: Characteristic herbal aroma of combined *Dravyas*
- Consistency: Clear liquid with fine sediment at bottom
- Yield: 5 liters from initial 19 liters

Precautions

- Use only Yavakūta (coarse powder) for optimal extraction; fine powder causes excessive turbidity.
- Employ chemically inert vessels (stainless steel/iron) to prevent phytoconstituent leaching.
- Mild-moderate flame maintained throughout.
- Keep vessel uncovered during boiling for proper evaporation and concentration control.

Preparation of Prakṣepa Cūrṇa

All Prakṣepa dravyas (Vaṁśalochana, Pippalī, Tvak, Elā & Patra) were examined manually to remove foreign matter and then dried thoroughly in sunlight to remove moisture. Each ingredient was separately pounded using mortar-pestle and finely powdered by mixer grinder, followed by sieving through cloth to obtain uniform cūrṇa. The sieved powders were mixed in prescribed proportions to get a homogeneous, aromatic blend.

Table 2: Observations on preparing Prakṣepa Cūrṇa

Total quantity taken for prakshepa dravya	**428g**
Total quantity obtained	**380g**
Loss	**48g**
Total time duration	**1.5hr**

Precautions

- Remove all physical impurities (dust, stones, insect debris) before processing.
- Use completely moisture-free raw materials to prevent microbial growth during powdering.
- Wear mask/gloves throughout to maintain personal and product hygiene.
- Pack final cūrṇa immediately in airtight containers to protect from moisture/humidity.

Preparation of Kulathaguda Avaleha

The prepared Kwatha was taken in a stainless-steel vessel and jaggery was added in the prescribed quantity to prepare a Guda-syrup. The mixture was heated with gentle stirring until Guda dissolved completely, then filtered again to remove any insoluble impurities or scum. The filtered syrup-Kwatha mixture was further boiled on mild flame with continuous stirring until classical Avaleha Pāka Lakṣaṇa appeared, such as:

- Tantumatva (formation of 2–3 threads between fingers)
- Darvī-pralepatva (adhering to ladle)
- Apsumajjanam (sample sinks in water)
- Sthiratva (semi-solid consistency on cooling)

After attainment of proper Pāka, the vessel was removed from fire and Prakṣepa Cūrṇa was added gradually with continuous stirring to avoid lump formation and ensure uniform dispersion. When the mass cooled to room temperature, required quantity of Madhu was added slowly and stirred thoroughly until a homogeneous, glossy, semi-solid Avaleha was obtained. From 7.3 lr of total raw materials, the final yield of Kulathaguda was about 1.9 kg, which reflects significant concentration and evaporation typical of Avaleha Kalpana.

The finished Avaleha was filled into pre-sterilized, dry, wide-mouthed glass containers, sealed air-tight and labeled with name, batch number (01-KG-24), date of preparation, expiry (3 years from manufacture) and storage instructions (cool, dry place, away from sunlight).

Table 3: Observations on preparing Kulathaguda

Total quantity taken	7.3lr
Total quantity obtained	1.9kg
Color	Brownish-black, typical of *Avaleha* formulations
Consistency	Semi-solid
Taste	Sweet-astringent-pungent
Time duration	5hrs

Precautions

- Flame intensity carefully regulated throughout.
- Continuous stirring ensures uniform cooking and prevents sticking/burning at vessel base
- *Prakṣepa Dravyas* added only after flame removal to retain volatile therapeutic principles
- Honey added only after cooling the avaleha.
- Immediate airtight sealing prevents moisture absorption and environmental contamination.

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PHARMACEUTICAL PROCEDURE








Analytical Study
The analysis was carried out at ALN Rao Memorial Ayurvedic Medical College & PG Centre, Koppa, Karnataka.
All tests were conducted using modern scientific parameters, following the quality assessment guidelines provided by the Central
Council for Research in Ayurvedic Sciences (CCRAS) under the Ministry of AYUSH, Government of India.

EVALUATION
It can be done on following parameters

- Organoleptic Evaluation
- Physico-chemical
- Biological
- Quantitative estimation

GENERAL /ORGANOLEPTIC EXAMINATION-

1. Rūpa (Colour) – Visual appearance of the drug
2. Rasa (Taste) – Perceived taste upon oral intake
3. Gandha (Odour) – Smell or aroma of the drug
4. Sparśa (Consistency & Texture) – Feel of the drug to the touch

PHYSICO-CHEMICAL EVALUATION -
It includes the following parameters

1. pH Value
2. Loss on drying at 105°C / Moisture content
3. Total Ash
4. Water soluble Ash
5. Acid insoluble Ash
6. Water soluble extractive
7. Alcohol soluble extractive
8. Sugar content (Reducing, Non-reducing & Total Sugar)
9. Chromatographic methods- viz T.L.C.

BIOLOGICAL EVALUATION - It includes

1. Microbial limit test
2. Test for specific pathogen

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Analytical Results

A. ORGANOLEPTIC CHARACTERS

Sl. No.	Parameters	Appearance of Specimen Sample
1.	Colour	Brownish Black
2.	Odour	Characteristic
3.	Taste	Sweet, astringent, pungent
4.	Texture	Semi-solid

B. PHYSICO-CHEMICAL PARAMETERS

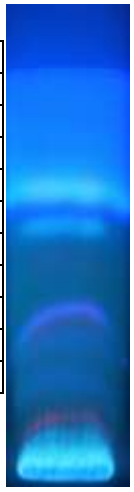
Sl. No.	Test Parameters	Results
1.	Loss on Drying at 105°C	16.57 %
2.	Total ash	13.55 %
3.	Acid insoluble ash	2.12 %
4.	Water soluble ash	6.79%
5.	Alcohol soluble extractives	19.49 %
6.	Water soluble extractives	42.61 %
7.	pH (5% aqueous solution)	4.69 ± 0.10
8.	Total Sugar	51.85 %
9.	Non-reducing Sugar	6.41 %
10	Reducing Sugar	45.45 %

C. FLUORESCENT TESTS

Sl. No.	Parameters	Under Visible Light	Under Long UV
1.	Sample + water	Greenish-brown	Fluorescent green
2.	Sample + MeOH	Brownish yellow	Fluorescent yellow
3.	Sample + 10% NaOH	Brownish Orange	Fluorescent green
4.	Sample + 10% HCl	Yellowish brown	Fluorescent yellow
5.	Sample + 10% HNO_3	Orange brown	Fluorescent yellow
6.	Sample + 10% H_2SO_4	Brownish yellow	Fluorescent green
7.	Sample + 10% NH_3	Dark brown	Brown

Solvent System: Toluene: Ethyl acetate: 9:1

Sl. No.	Rf Values	Under Long UV
1.	0.04	Bright Fluorescent green
2.	0.05	Bright Fluorescent green
3.	0.11	Fluorescent blue
4.	0.23	Fluorescent blue
5.	0.35	Fluorescent blue
6.	0.42	Fluorescent blue
7.	0.63	Fluorescent green
8.	0.72	Bright Fluorescent green
9.	0.79	Fluorescent green
10.	0.86	Fluorescent blue



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D. PRELIMINARY PHYTOCHEMICAL TESTS (QUALITATIVE TESTS)

Sl. No.	Test Parameters	Results
1.	Carbohydrate	Present
2.	Protein	Present
3.	Alkaloid	Present
4.	Cardiac glycoside	Present
5.	Flavonoids	Present
6.	Tannins	Present
7.	Antraquinone glycoside	Present
8.	Triterpenoides	Present

E. MICROBIAL CONTAMINATION

Sl. No.	Test Parameters	Results
1.	Total aerobic count	1.2×10^2 CFU
2.	Total fungal count	1.3×10^2 CFU

F. Quantitative Estimation

Parameters	Results
Total sugar	51.85%
Reducing sugar	45.45%
Non- reducing sugar	6.41%

DISCUSSION

The pharmaceutical validation of Kulathaguda demonstrated a moderate conversion efficiency, which reflects the expected water loss during Kwātha reduction and subsequent Pāka processing as described in classical Avaleha Kalpanā.Sequential attainment of *Pāka Lakṣaṇas* like *tantumatva* (thready consistency), *darvī-pralepatva* (adhesion with ladle), *apsumajjanam* (sink in water), and *sthiratva* (semisolid consistency) confirmed optimal syrup density, essential for microbial stability and phytoconstituent preservation. Documented GMP precautions (mild heating, sterile handling, precise proportioning) ensure manufacturing reproducibility suitable for pharmacopoeial compliance and industrial scaling.

Analytical profiling establishes comprehensive quality benchmarks. Physico-chemical parameters reveal moderate moisture content i.e.16.57%, balanced physiological ash (13.55%), and exceptionally low acid-insoluble impurities (2.12%), confirming raw material authenticity. Superior water-soluble extractive is 42.61% indicates predominance of hydrophilic therapeutic moieties; glycosides, mucilages, sugars optimally suited for respiratory tract bioavailability. Slightly acidic pH (4.69) synergizes with osmotic sugar matrix (51.85% total sugars, 45.45% reducing) for natural preservation, while maintaining palatability critical for chronic therapy compliance.

Phytochemical screening validates classical pharmacodynamics: flavonoids substantiate bronchodilatory-antihistaminic effects, alkaloids mediate expectorant action, tannins provide astringent *Kaphahara* properties, triterpenoids contribute anti-inflammatory-immunomodulatory benefits, and cardiac glycosides support tonic effects in respiratory distress. The TLC fingerprint (10 characteristic Rf bands: 0.04-0.86 under UV 365nm) constitutes a gold-standard authentication tool, distinguishing genuine *Kulathaguda* from adulterants through reproducible chromatographic pattern. Green fluorescent bands (0.04, 0.05, 0.72) likely represent flavonoid glycosides; blue bands indicate phenolic derivatives, valuable for future densitometric standardization.

Microbiological safety (TAMC 1.2×10^2, TFC 1.3×10^2 CFU/g) significantly below API limits ($\leq10^3$ CFU/g) validates GMP-compliant processing hygiene, raw material quality control, and 3-year shelf-life declaration. Relative to published *Avaleha* standards, *Kulathaguda* demonstrates superior hydrophilic extractive values and cleaner inorganic profile, positioning it favorably for pharmacopoeial inclusion.

CONCLUSION

The pharmaceutico-analytical study of Kulathaguda, prepared as per Chakradatta and processed through scientifically monitored steps, has yielded a standardized Avaleha with well-defined organoleptic, physico-chemical, phytochemical, chromatographic and microbiological profiles. The inclusion of clearly documented pharmaceutical methodology and analytical benchmarks will support academic, regulatory and industrial efforts to adopt Kulathaguda as a validated formulation for its traditional indications, while future work can focus on experimental pharmacology and controlled clinical trials.

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