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"*PANCHAVIDHA KASHAYA KALPANA* THROUGH THE LENS OF EXTRACTION SCIENCE: SOLVENT, TEMPERATURE AND YIELD"

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ABSTRACT

Background: The five basic preparations of Ayurveda, *swarasa* (expressed juice), *kalka* (paste), *kwatha* (decoction), *hima* (cold infusion) and *phanta* (hot infusion), are the foundation of most other dosage forms. Each represents a distinct extraction method, defined by solvent ratio, temperature and duration. **Objective:** To interpret the five preparations in terms of extraction science and to review the evidence on how their process variables affect composition, yield and quality. **Methods:** A critical narrative review of classical process descriptions and of pharmaceutical, analytical and quality studies of *kwatha* and related preparations. **Results:** The preparations form a graded series of aqueous extraction methods. *Kwatha* uses 4, 8 or 16 parts of water depending on the hardness of the drug, with boiling on mild heat (often cited as about 85–90 °C) until the volume is reduced to one-quarter or one-eighth; *hima* uses about six parts of water overnight at ambient temperature; *phanta* uses about four parts of hot water until cool. Studies show that water quantity, particle size, plant part and scale of manufacture alter composition, and that industrial steam-jacketed extraction can reduce processing time from 16–21 to about 6 hours with comparable yield. Commercial ready-to-use *kwathas* contain preservatives, sometimes at high levels, and can differ in phytochemical markers from freshly prepared decoctions. **Conclusion:** *Panchavidha kashaya kalpana* encodes rational extraction principles. Defining particle size, solvent ratio, temperature and end-point, together with marker-based standardisation, would make these preparations reproducible.

KEYWORDS: *Panchavidha kashaya kalpana*; *Kwatha*; *Hima*; *Phanta*; *Swarasa*; Extraction; Decoction; Standardisation

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INTRODUCTION

The *Sharangadhara Samhita* describes five basic forms in which drugs are prepared, known collectively as *Panchavidha kashaya kalpana*: *swarasa*, *kalka*, *kwatha* (*shrita*), *hima* (*sheeta*) and *phanta*. They are listed in order of decreasing potency and increasing lightness, and most other dosage forms, including *avaleha*, *sneha kalpana*, *sandhana kalpana* and *ghana*, are derived from them[1]. Each of the five corresponds to a recognisable extraction method: mechanical expression, wet grinding, decoction, cold maceration and hot infusion[2].

Extraction science explains the yield and composition of an extract in terms of the solvent, the ratio of solvent to material, the particle size, temperature, contact time and agitation[3,4]. This review uses these variables to interpret the classical preparations and examines the experimental evidence on how they influence quality.

METHODS OF THE REVIEW

This is a critical narrative review. Literature was identified through PubMed, PubMed Central, DOAJ, Crossref-indexed records and journal archives using the terms *Panchavidha kashaya kalpana*, *kwatha*, *kashaya*, decoction, *hima*, *phanta*, *swarasa*, extraction and standardisation. Classical process descriptions, pharmaceutical and analytical studies, and quality surveys of commercial products were included.

THE FIVE PREPARATIONS AS EXTRACTION METHODS

Table 1. *Panchavidha kashaya kalpana* interpreted as extraction methods

Preparation	Classical method (summary)	Extraction principle	Key variables
Swarasa	Fresh plant crushed and juice expressed	Mechanical expression of cell sap	Freshness, plant part, pressing efficiency
Kalka	Fresh or dried drug ground to a paste with little water	Wet comminution; whole drug administered	Particle size, water content
Kwatha	Coarse drug boiled with 4, 8 or 16 parts water on mild heat and reduced to 1/4 or 1/8	Decoction: prolonged hot aqueous extraction with concentration	Water ratio by hardness, temperature, reduction, particle size
Hima	Drug soaked in about 6 parts water overnight at room temperature	Cold maceration	Contact time, particle size; preserves thermolabile and volatile constituents
Phanta	Drug added to about 4 parts hot water and left until cool	Hot infusion: short contact at falling temperature	Initial temperature, contact time, particle size

The five preparations can be arranged along two axes: intensity of extraction and degree of concentration. *Swarasa* and *kalka* administer the whole fresh material with little or no extraction. *Hima* and *phanta* are gentle extractions with short or cool contact, suitable for aromatic or heat-sensitive drugs. *Kwatha* is the most exhaustive, combining prolonged heating with concentration by evaporation[2,5].

KWATHA: THE MOST STUDIED PREPARATION

1. Solvent ratio

The amount of water depends on the hardness of the drug: four parts for soft, eight for medium and sixteen for hard materials, with adjustments according to the quantity of drug[5,6]. This is consistent with extraction science: hard, woody materials release their constituents slowly and need more solvent and longer contact. The effect of water quantity has been tested experimentally: different amounts of water used for *Guduchi kwatha* gave different yields of *Guduchi ghana*[7].

2. Temperature and reduction

Classical texts prescribe mild heat (*mandagni*) in an open vessel. Reviews interpret this as about 85–90 °C, which limits degradation of thermolabile constituents[5,6]. The end-point is reduction of the volume to one-quarter or one-eighth, depending on the source[2,6]. Reduction concentrates the extract, increasing the dose of solutes per unit volume, but prolonged heating can also degrade or transform constituents.

3. Particle size and plant part

Coarse powder (*yavakuta*, about the size of a barley grain) is classically preferred, whereas finer powders of 60–100 mesh are commonly used today[5]. Finer particles extract faster but can make filtration difficult

and carry more insoluble material into the decoction. The effect of particle size has been studied in the preparation of *Phalatrikadi kwatha*[8], and the choice of plant part, root bark versus stem bark, influenced the pharmaceutical characteristics of *Brihatpanchamoola kwatha*[9].

4. Shelf life

A freshly prepared *kwatha* has a classical potency period of about three hours (one *yama*)[5,6]. This short life reflects microbial growth in a nutrient-rich aqueous extract at ambient temperature and is consistent with modern understanding.

FROM FRESH DECOCTION TO COMMERCIAL PRODUCTS

Table 2. Studies of commercial and modified *kwatha* preparations

Study	Focus	Main findings
Industrial extraction	Steam-jacketed extraction with size reduction	Boiling time reduced from 16–21 h to about 6 h with comparable yield
Spray drying	Concentration to 22–25% total dissolved solids then spray drying	Dehydrated powder not requiring preservative
Cirivilvadi kashaya	Freshly prepared vs commercial scale	Differences in specific phytochemical indicators
Sahacharadi kwatha	Three commercial brands	Quality parameters and preservative concentrations compared
Nayopayam kwatha	Standardisation protocol	Phytoconstituent assessment and protocol development
Pathyashadangam kwatha	HPLC and HPTLC	Phytochemical analysis and marker-based standardisation

Commercial manufacture has transformed *kwatha*. Ready-to-use liquid *kashayams*, granules, tablets and spray-dried powders are now common. Industrial steam-jacketed extraction with size reduction has been reported to shorten boiling from 16–21 hours to about six hours with comparable yield, and spray drying of concentrated decoction can give a stable powder without preservatives[5,10]. These changes improve convenience and shelf life, but they also change the product. A comparison of *Cirivilvadi kashaya* prepared freshly and at commercial scale found differences in specific phytochemical indicators[11]. Liquid commercial products require preservatives, and a comparison of three brands of *Sahacharadi kwatha* examined their quality parameters and preservative concentrations[12]; a recent review reported that sodium benzoate was very high in all three brands and noted unreported sugar in a market sample of *Dashamoola kwatha*[15].

TOWARD STANDARDISATION

Marker-based methods now allow *kwathas* to be characterised. Standardisation protocols using HPTLC, HPLC and other techniques have been developed for *Nayopayam kwatha* and *Pathyashadangam kwatha*[13,14], and approaches to standardising *kwatha* as a dosage form have been reviewed[16]. A rational standard would specify:

- **Raw material:** identity and quality of each ingredient, plant part and particle size range.
- **Process:** water ratio, soaking time, temperature range, duration or reduction end-point, and filtration.
- **Product:** total solids, pH, marker compounds for key ingredients, microbial limits and, for commercial products, preservative and sugar content.
- **Equivalence:** for modified forms such as granules, tablets or spray-dried powders, demonstration that marker profiles match the fresh decoction.

HIMA, PHANTA AND SWARASA

The other preparations have received less experimental attention. Their extraction principles are clear: *hima* is a cold maceration suited to mucilaginous, aromatic or heat-sensitive drugs, *phanta* a brief hot infusion similar to tea, and *swarasa* a mechanical expression of cell sap[2]. Comparative studies of *kwatha*, *hima* and *phanta* of the same drug, measuring marker yields and activity, would show whether the classical choice of method for particular drugs is reflected in their chemistry.

RESEARCH GAPS

Key gaps include: systematic studies of temperature and duration on marker yield and degradation; comparisons of *hima* and *phanta* with *kwatha*;

equivalence studies of modified dosage forms; preservative and contaminant surveys of commercial products; and microbiological studies defining the safe holding time of fresh decoctions.

CONCLUSION

Panchavidha kashaya kalpana represents a graded series of aqueous extraction methods whose classical rules on solvent ratio, temperature and end-point are consistent with extraction science. Experimental studies show that water quantity, particle size, plant part and scale of manufacture change the composition of *kwatha*, and that commercial products can differ from fresh decoctions. Specifying process variables and adopting marker-based standards would allow these foundational preparations, and the many dosage forms derived from them, to be produced reproducibly.

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