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A Critical Review and Significance of Ayurvedic preparation Kwatha - Herbal decoction

Review Article

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Abstract

The standardization of Ayurvedic classical dosage forms has been an area of academic, research, industrial and regulatory interests. It is crucial to understand the basic principles and rationality of these dosage forms for their therapeutic relevance while adapting to newer technologies for its right pharmaceutical and clinical use. *Kwatha Kalpana* -frequently referred to as decoctions - aqueous extraction of a group of herbs, is one of the most commonly used classical dosage forms where the therapeutic attributes are extracted from the group of botanicals into water, with the use of heat. Though clinically effective, it is seldom used due to the cumbersome preparatory method, short shelf life and poor palatability. This elaborate review covers historical and basic concepts of the dosage form, its salient features, nuances of classical preparations, traditional and newly developed methods of preparations. This paper covers intricate classical information and specifics about *Kwatha,* the herbal decoction.

Key Words: *Ayurvedic dosage form, Kwatha, Kashayam, Decoction, Standardization, Ayurvedic teas, Ayurvedic Pharmacy.*

Introduction

Kwatha Kalpana - decoction or infusion is a well-known Ayurvedic dosage form based on the principle of boiling and obtaining water-soluble constituents from herbs. *Kwatha,* decoction is one of the *panchvidha kashaya kalpana* (1) i.e. group of five main categories of Ayurvedic pharmaceutics: the others being *Swarasa* - fresh juice, *Kalka* - paste, *Hima* - cold infusion and *Phanta* - hot infusion. As a dosage form, *Kwatha*, the herbal decoctions have a wide range of therapeutic uses in the treatment of various diseases. *Kwatha* is also used as an ingredient to prepare other dosage forms used orally such as for *guti-vati* – pills, *avaleha* - medicinal jams, *ghrita* - medicinal ghee or *asava-arishta*- medicinal wines and topically as for medicinal oils and several other forms.

Need for the Review of Ayurvedic Dosage Forms

'*Bhaishajya Kalpana*' – Ayurvedic pharmaceutics is a well-developed sub-discipline of Ayurveda covering more than 40 pharmaceutical dosage forms to provide a variety of therapeutic solutions. It describes all the details, including identification of raw materials and the meticulous methods of preparation. *Kwatha* – herbal decoction as an age-old dosage form has not only been sustained, but has also progressed into newer forms as marketable products. It is important to understand the basic principles and evolution of this traditional dosage form based on Ayurvedic classical literature and to review it in the context of modern pharmaceutical developments. A similar review on *Asava- arishta*, self-generated alcohol-based products was carried out by us.(2)

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Review of the classics

Ayurvedic literature comprises of *vedic, samhita* and *nighantoo* – compendia texts.

***Vedic* Period** (1500-500 BCE)

Vedic literature refers to *Kashaya* formulation. There are *vedic* references of decoctions namely *Dashmoolkashaya* and *Parushakadikashaya* to treat ailments and of combining *dravya* – substance to *jala* – water as formulations. *Atharvaveda* (3) describes '*Karambh'* which is prepared with *aushadhi dravyas* - medicinal substances and water. A reference of decoction made of *Haritaki* - *Terminalia chebula* Retz. is indicated for dental ailments.(4)

***Samhita* Period** (300-500 BCE)

The *samhitas,* the Ayurvedic treatises describe the methods of preparation of *'Shrita'* – decoction and their classifications as used to treat different diseases. *Charaka Samhita* mentions that decoction being prepared with heat is lighter to digest than the fresh juice and paste.(1) It also provides details of the preparation in which *dravya* - raw drug is boiled with

drava - liquid media for a specific period. *Ashtang Hridaya* describes the method like *kwatha* for preparation of *Shrita.*(5)

Chakrapani, the commentator of *Charak Samhita* suggests the tastelessness of residual material as indicative of the right preparation.(6) *Sushrut Samhita* includes *Kashaya kalpana*, *kwatha* as one of the six types of basic forms, the sixth being *Ksheera kalpana* - milk based products.(7)

Compendia

Sharangdhar Samhita, (14th Century A.D.) a well-known compendium on formulations, uses the terms *Shruta, Kashaya,* and *Niryuha* for decoction. The text has a separate chapter with detailed description about the preparatory methods of different decoctions that relate to its use for different ailments. It has also described *upakalpanas* - allied variants, namely *Pramathya* where raw plant parts are added in the form of paste, *Yavagu,* a gruel prepared in a similar way with rice, *Yush,* gruels using different pulses, *Shadangapaneeya,* medicated water with six constituents, *Ksheerapaka*– milk boiled with plant parts, and other *Aharakalpanas* - dietetic preparations having medicinal values like *Manda* - watery portion of rice gruel, *Peya*– gruel made with cooked rice and *Vilepi*- thick rice gruel and others.(8)

Bhavaprakash (16th Century AD) a well-known compendium of classical products using natural ingredients provides variable ratios of plant parts to water for preparation of decoctions to be administered into three groups as large, medium and small.(9)

Kashyapa samhita, (6th Century BCE) a treatise mainly covering the health of women, children and reproductive system includes seven types of dosage forms as *churna* - powder, *sheeta Kashaya* - cold infusion, *swarasa* - expressed juice, *abhishava* – fermented preparations, *phanta* - hot infusion, *kalka* – paste *and kwatha* – decoction with details of methods of preparation.(10)

Harita Samhita describes seven types of *Kashaya* and also suggests lesser reduction of water for *tarpana* – nourishing purpose and stronger process, higher water reduction for *apatarpana*– cleansing (11). *Todarananda,* a later period author has described similarly seven types of decoctions along with their therapeutic attributes.(12)

Definitions of terms

The word *Kashaya* generally refers to *kashaya rasa* (astringent taste); '*Ka*': denotes *kaya -shareera* (body); '*Sha*': denotes functions; '*Ya*': denotes appropriate regulation. *Kashaya* means the one that helps regulate body functions or helps maintain equilibrium (13,14). *Vaidyaka Shabdasindhu* (15), classical text on Sanskrit medical terms implies that *kashaya* is *kwatha* - decoction. *Vachaspatyam,* an ancient Sanskrit dictionary has defined Kashaya (16) - kashhinsayamdhatu + aaypratyayakashati kantham as one meant to remove doshas from kantha – throat, the upper part. Ayurvediya Shabdakosh, a lexicon of Ayurvedic terms explains it as a shrut-kwathitam or utkwathitam, boiled dosage form that krupsamrthaye dhatu enables metabolism.(17)

Kwatha is a type of medicinal preparation in which coarsely powdered raw ingredient/s of natural origin are boiled with the liquid medium, usually water, for a fixed time until reduced to the desired volume. Thereafter, the entire product is filtered through a clean cloth. The liquid obtained after filtration is called a decoction.(18)

Salient features

- Herbal decoction is an effective and forceful dosage form as the water-soluble attributes of the herbs are extracted during the heating process to form a new product.
- Decoction is a liquid dosage form with water that is absorbed better and faster in the intestinal tract.
- It is considered *laghu* – lighter or, easy to absorb or metabolize.
- It is commonly indicated in many disease conditions.
- It provides a base for several other dosage forms like *Avaleha* - linctus, *Snehapaka*- Medicated oil and *Ghee*, *Sandhankalpana*– Fermented preparations and others.

Pharmaceutical process

Traditional Method of Preparation

Classical texts provide different methods of preparing *Kwatha.*

Charak Samhita

The medicinal herbs must be carefully examined for quality, cut into small pieces and washed thoroughly with water. Cow's urine is advised, if needed, to be added to half of the quantity of water. Cow's urine is commonly credited to remove all impurities. The material is to be boiled till it gets fully extracted in the water when the material becomes tasteless - *gataraseshu aushadheshu.(19)* The mixture is to be stirred intermittently to avoid herbs getting burnt or stuck at the bottom of the vessel. According to *Chakrapanidutta,* the commentator of *Charak Samhita* after boiling, about 3/4th of the water gets evaporated and when the extracted mass becomes tasteless, it is the confirmatory test of *Kwatha*. Generally, the decoction is prepared till the water gets reduced to 1/4th unless otherwise specified.(7)

Sushruta Samhita

Sushruta along with the process (20) suggests the use of sun dried *tvak* - bark, *patra* - leaves, *phala* – fruits and *moola* - root for preparation of decoction to use as a base for *Snehapaka* - preparing lipid-based formulations. *Dalhan, its commentator,* also provides the process for preparation of Rasakriya.(21)

Ashtang Sangraha

Vagbhatt recommends that the dried herbs be coarsely cut. The wide mouth vessel of copper, iron or earth is to be used to prepare a decoction. The water is to be added to the herbs and then boiled on low flame

with continuous stirring and suggests use of lukewarm decoction after filtration.(22)

Sharangadhara Samhita

Sharangdhara suggests the use of an earthen vessel (23**)** and it should not be covered while boiling as it changes the attributes of decoction from *laghu*- easy to digest, to *guru*- hard to digest.(24)

Kashyapa Samhita

Kashyapa samhita states that one part of the drug is to be added with 4 or 8 times of water. The mixture is to be boiled on low flame till it reduces to 1/4th of the quantity. *Kashyap Samhita* recommends the dose variation based on *rugnabala* - strength of the patient and *vyadhibala* - severity of the disease.(25) This process of preparation is endorsed by the recent scholars like Vaidya Yadavji Trikamji Acharya.(26)

Preparation

Collection of Crude Drugs

The raw material should be free of any extrinsic matter and other residual contaminants or pesticides. The ingredients must be authenticated and should be collected and stored under hygienic conditions in required quantity.

Vessels for Kwatha

Traditionally used earthen pots (27) help control temperature, minimize environmental exchange and prevent loss of active or volatile substances. Metallic coated copper vessels and vessels with a coating of wet soil from outside were also used instead of an earthen pot.(28) Presently stainless-steel vessels are preferred due to availability, cost efficiency and easy maintenance**.**

Proportion of water

The proportion of water is recommended by different authors with respect to the therapeutic relevance of *kwatha* (29, 30, 31) [Table 1]. It is indicated that the proportion of water varies with respect to hardness of the raw herbs used, e.g. *mrudu* - soft, *madhyam*- medium, *kathin* - hard and *atyant kathin*- harder; especially while preparing *Snehapaka* – oleaginous dosage form. (32,33)

Table 1: Variation in Proportion of Water and Reduction

Author	Proportion of water and reduction					
	1:16⟶1/8th	**1:16⟶1/4th**	**1:16⟶1/16th**	**1:8⟶1/4th**	**1:4⟶1/4th**	**1:8 or 16⟶ 1/8th or 1/16th**
Adhamalla		+				
Arunadutta		+				
Bhavamishra	+	+				
Chakrapanidutta		+		+	+	
Dalhana			+			+
Govindacharya			+	+		+
Hemadri		+				
Kashyapa		+				
Sharangadhara	+					
Sushrut		+		+	+	

Sharangadhara, in the chapter of preparation of oleaginous dosage forms – *Sneha Kalpana* recommends reducing the quantity of water proportionate to the increased quantity of ingredients to acquire maximum extractives with the process of boiling [Table 2].

Table 2: Recommended Quantity of Water with Respect to Quantity of Ingredients (33)

Quantity of Ingredients	Volume of Water	Quantity after Reduction
One *karsh* to one *pal* [12 grams to 48 grams]	16 times	1/4th
More than 1 *pal* up to 1 *kudava* [48 grams to 192 grams]	8 times	1/4th
More than 1 *kudava* to 1 *khari* [192 grams to 196 kg]	4 times	1/4th

Heat, Temperature

Heat, temperature is an important factor because there are chances that temperature can decompose some of the thermo-labile active constituents. Classical texts have suggested *mandagni* - mild heat for preparation of decoction which is usually maintained between 85-90°C.(34) During the process occasional stirring is required for proper homogenous treatment to the substances.(35)

Particle size of raw materials

The particle size of raw material is customarily *Yavkutchurna*– coarse powder or the size of barley grains.(36)

Duration of heating

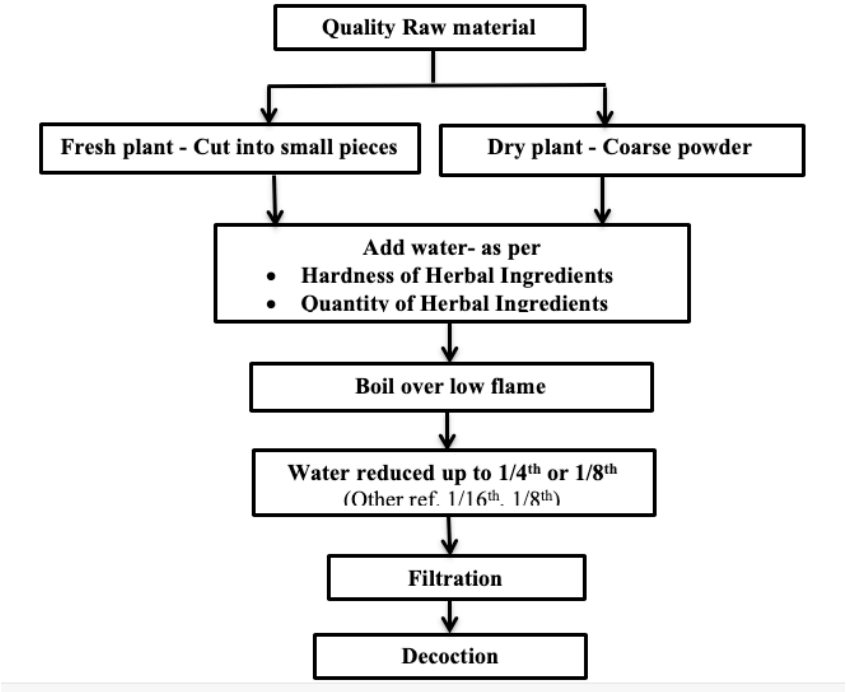
The attribute of decoction – *guru* – slow acting and *laghu* – fast acting depends upon greater or lesser duration of heat respectively.

Procedure

Fresh herbs are cut into small pieces and dry herbs are reduced to coarse powder. The ingredients are soaked in water overnight. The mixture is then boiled on slow flame with continuous stirring till the water gets reduced to the desired quantity.

The mixture is filtered with clean cloth to get the final product – decoction.

Figure - 1 Method of Preparation of Decoction



Therapeutic Classification of Kwatha, Decoctions

Harita has classified *Kwathas* as *Saptavidha kashay kalpna* (10) – 7 types as per the therapeutic activity. The desired maximum therapeutic effect is brought out with the administration of the decoction at specific time [Table 3].

Table 3: 7 Types of *Kwatha* as per Therapeutic Activity and Time of Administration

Sr. No.	*Kwatha* type as per therapeutic activity	Proportion of Reduction	Time of administration
1	*Pachana* - Digestive	½	*Nisha;* 2nd *yama* - Night
2	*Deepana* - Appetizing	1/10th	*Aparhana* -Afternoon
3	*Shodhana*-Purifying	1/12th	*Suryodyatpurve* - Just before sunrise
4	*Shamana* - Alleviating *doshas*	1/8th	*Poorvhane* -Mid-morning
5	*Tarpan* - Replenishing	Equal	*Prabhate* - Early morning
6	*Kledana* - Lubricating	1/4th	*Prabhate* - Early morning
7	*Shoshana* - Absorbing	1/16th	*Nishithe;*3rd *yama* - Night

Charak, and *Bhoja*, a later period author has provided the proportion of water as related to therapeutic administration for Ayurvedic treatments (37) [Table 4].

Table 4: Variation in Water Quantity and Reduction as per Therapeutic Use

Therapeutic administration	Quantity and Reduction of water		
		Bhoja	Charak
Aschotana - Eye drops	6	1/6th	1/5th
Asthapana / Niruha Basti –Medicated Enema	6	1/7th	1/32th
Gandush - Gargling	4	1/5th	1/6th
Mukhaprakshalana - Mouth Cleanser	8	1/9th	-
Sneha - Oleaginous item	4	1/4th	1/4th
Seka - Fomentation	4	1/8th	1/2th
Vranaprakshalan / Vranashodha Wound Cleansing	3	1/12th	1/16th
Vamana - Emesis	3	1/2th	-
Pana / Paneeya - Medicated Water	24 30	1/8th 1/4th	1/8th
Ushnodaka - Warm Water	1	1/3th	-
Yavagoo - Nutritional Gruel	64	1/8th	-

Prakshepa Dravya – Additives

Additives are added to increase palatability, therapeutic efficacy and stability of the final product. The quantity of additives varies as per the desired therapeutic effect (38) [Table 5].

Table 5: The Additives and Quantity

Additives	Quantity	Disease
Madhu– Honey	1/16th of decoction	*Vataja*
	1/8th of *kashaya*	*Pittaja*
	1/4th of *kashaya*	*Kaphaja*
Sharkara– Sugar	1/16th of *kashaya*	*Kaphaja*
	1/8th of *kashaya*	*Pittaja*
	1/4th of *kashaya*	*Vataja*
Ksheera- Milk, *Ghrita*-*Gomutra*- Cow's urine, *Dravadravya*-Liquid, *Kalka*-Paste, *Churna* -Powder, *Guggulu*- Gum resin [Formulations prepared from resin of Commiphora mukul]	1 *karsha- 10 gram*	-
Jiraka- *Cuminum cyminum*, *Guggulu*, *Lavana*- Salt, *Shilajatu*- Asphaltum, *Hingu* - Resin of *Ferula narthex*, *Trikatu– 3 pungents* - Black pepper (*Piper nigrum*), Long pepper (*Piper longum*) and powder of Ginger (*Zingiber officinale*)]	1 *shana* each- 3 gram each	-

Quality Parameters - Siddhi lakshana (39)

- The decoction should have the aroma, taste and color of the ingredients used.
- It should be free of any suspended particles.
- The residue after filtration should be tasteless.
- The expected or desirable quantity should be obtained as a final product.

Poor-Quality of Decoction

The decoction that becomes *Krishna* - black, *neela* - blue and *raktavarna* - red in color or *picchila* - sticky, *dagdha* - over-heated, *kunapagandhi* or *visragandha* - odor loses its efficacy and should not be used.(40)

Finished Product

The decoction that encompasses *varna*– color and *gandha*- smell of the ingredients, and does not have *ghanatva*- hardness or *picchilata*- stickiness is *uttama*- of optimum quality and *amrutopama*–effective.(39)

Administration (41)

The decoction is to be consumed lukewarm and only after proper digestion of *aaharrasa*–food. It should not be consumed after meals.

- Generally, and specially in *Vata* disorders it is prescribed to be consumed lukewarm and cold in *Pitta* disorders.
- The decoction is to be consumed in the morning unless otherwise specified.
- Decoction should not be reheated.

***Matra*- Dosage**

The dosage of the decoction varies as per the age and disease condition. [Table 6]

Table 6: Dosage

Acharya Sharangadhara (41)	2 *palas* (96 ml)
Vachaspatyam(42)	
Uttamamatra –Ideal dose	1 *pala* (48 ml)
Madhyamamatra – Medium dose	3 *Karsha* (36 ml)
Avaramatra – Minimum dose	1/2 *pala* (24 ml)
Deeptanala mahakaya–For good digestive capacity	1 *Anjali* (120 to 280 ml) *variable as per individual need.*
Others	1 *Prasruti (96ml)*

Shelf-Life (43)

Shelf-life of decoction is one *yama*- 3 hours.

Storage

The decoction is not intended for storage.

Advantages and Disadvantages

Advantages

- Decoction is prescribed for both internal as well as external ailments.
- It is absorbed quickly through the gut because of large surface area.
- It has a wide range of therapeutic uses.
- It is useful for different modes of administration, e.g. *basti*- medicated enema, *nasya*- nasal drops, *nadisweda & dharasweda*–variety of hot foementation, *dhavana*- washing, *prakshalana*- cleansing and *ashchotana*- eyedrops.
- It is used as a base to prepare other formulations, e.g. *ghrita* -medicated *ghee*, *taila* medicated oil, *arishta*- medicated wine and others.
- It is used in other pharmaceutical processes e.g. as *bhavana dravya*- trituration, *shodhana dravya*- detoxification and *anupana*- vehicle with other dosage form.

Disadvantages

- It has a small shelf life; microbial contamination occurs if stored for a long time.
- It is required to be administered in large quantities for desirable therapeutic effect.
- It has poor patient compliance because of taste, especially if bitter.
- Decoction, as a liquid requires extra care while handling, packaging or transport.
- Addition of preservatives in the context of commercial preparations may lead to undesired effects such as irritation of mucous membrane.
- It is not useful for heat-sensitive ingredients.
- Volatile components may be lost during heating.
- Altered method of preparation on a large scale, if not done right, may lead to compromised efficacy and at times adverse effect if not stored right.

Upakalpana of Kwath-allied formulations of decoction

Though decoction forms a base of many Ayurvedic formulations the scarcity of crude herbs, the short life of decoction, the not so acceptable taste and dosage variations limit its use.

To overcome these problems, *Upakalpanas*- allied formulations are developed by using basic principles of *Pancha vidha kashaya kalpana*- five basic formulations. The development of *Upakalpanas* aims at enhancing the potency and selectivity in the pharmacological activity. The following allied formulations can be categorized with *Kwatha kalpana*. [Table 7]

Table 7: Allied formulations of *Kwatha*

Formulation	Method of Preparation	Dosage	Indications
Pramathya (44) appetizer - Ingredients are added in form of paste]	Medicated paste 1 part + water 8 parts = reduce to 1/4th	1-2 *pala* (48-96 gm)	Digestive as *pathya (wholesome diet)*
Paneeya (45) - Medicated water	Ingredients - 1 part + water - 64 parts = reduced to half	2 *pala* (96 gm)	drinking and cooking
Ushnodaka (46) -Boiled water *Sadangpaniya,* Water with 6 ingredients	Lukewarm water	1/8th, 1/4th, 1/2th reduction of water.	Base for decoction and such other formulations. Indigestion, Fevers
Ksheera paka (47) - Medicated milk	1] Herbs: Milk: Water (1:8:32) 2] Herbs: Milk: Water (1:15:15) Boiled till *ksheeravashesha* the water part gets reduced	Specific to indication and the patient	*Amashoola, Jeernajwar* - Chronic fever *Arjunkshirpaka*– Cardiovascular diseases *Rasonakshirpak*- Rheumatoid arthritis
Mamsa Rasa(48) Meat soup	2, 4, 6 and 8 parts of water is added as per the nature of chopped meat	---	*Preenan*- replenishment. anorexia, cough, asthma

Modifications in kwatha kalpana (49,50)

The newer methods of preparations and modified forms have been developed for *Kwatha Kalpana* in the academic, commercial or industrial set up, and have some merits and demerits. [Table – 8]

Table 8: Modifications in *Kwatha Kalpana*

Modification	Merits and Demerits
Tablet, *Ghanavati*	Unit dosage form, taste of *kwatha* can be masked, easy administration, easy to carry, higher shelf life, patient compliant.
*Kashaya sookshmachurn*a	Can be stored for longer periods without losing its potency, less time-consuming.
Arishta	Increased shelf life, better palatability, self-generated alcohol acts as preservative, easy to absorb, quick in action. **Demerits**: takes more time for preparation.
Syrup	Better shelf life, palatable, small dosage. **Demerits**: Change in taste, also may compromise therapeutic activity.
Arka	Easy preparation and administration, no need of preservatives. lower dose, palatability, easy administration, longer shelf life.
Granules	Increase in bulk density, uniform particle size, safe, effective.
Dip bags / Sachets	Easy to use and store. Maintenance of the purity for instant preparation.

Failure in the preparation of kwatha - decoction

Product may get compromised as a consequence of not following the specific procedure. [Table 9]

Table 9: Failures in the Preparation of *Kwatha*- Decoction

Problems	Solutions
Vessels– Size and shape Shallow vessel – important constituents may get evaporated. Copper vessel, if not of good quality may react with some of the ingredients and may become toxic.	Long length and narrow mouth can help in preserving all-important phyto-constituents. Chemically inert vessels can be used.
Water – the change in quantity may compromise the therapeutic efficacy.	Water should be taken as per the ratio mentioned.
Heat, Temperature Control –if not regulated may decompose some of the important constituents.	Mild to moderate heat [85-90°C] should be maintained throughout the process.
Particle size of ingredients – the change in particle size compromises the efficacy of the final product.	Coarse powder should be used.

Industrial (Large scale) Production

Solid-Liquid Extraction Method (51)

In the large-scale industrial preparation (bottled decoction), steam jacketed vessels or boilers are used. In this method, instead of directly boiling the drug and water, heat is transferred to the mixture indirectly through steam filled jackets.

The drugs employed are washed, dried and the size is reduced to about 1/8th-1/4th that of their former size, crushed and then fed to the drug boiler. A mechanical revolving chipping machine is used for size reduction of drugs. The size reduction helps to reduce the boiling time from 16-21 hours to 6 hours and in turn obtain the amount of maximum extraction solution equal to that of the conventional boiling method. This extraction method saves time and material and improves the quality of the product compared to the conventional method because it reduces the caramelization to a great extent and at the same time becomes cost effective.

Prolongation of Shelf-life

Use of Preservatives

The shelf life of decoction is very small, and itis advised that it be used immediately after preparation. It cannot be preserved for a longer duration. Therefore, it becomes necessary to use the preservatives which are inert and could maintain drug potency for a longer period. Though there are many such preservatives available, sodium benzoate is preferred for the industrial production.(52)

Dehydration

Nowadays the decoction prepared is produced in the form of dehydrated powder with spray drying technique. It is concentrated to 22-25% T.D.S. (Total Dissolved Solids) in the solid dehydrated form that improves its shelf life. In this process, water- the medium responsible for putrefactive spoilage is eliminated, thereby no preservative is deemed necessary.(53)

Granules

The decoctions used previously are not preferred now because of the time-consuming process. It has given rise to different easily usable forms as industrial products. These various preparations in liquid form either contain sugar or preservatives or are in fermented form to increase the shelf life leading to variance in efficacy. Mostly, a mismatch is observed in the dose, as suggested of the fresh decoction and these liquids. Inappropriate dose consumption may also compromise the effectiveness. There are also issues of transportation because of the chances of leakage, breakage or spillage. Efforts are being made to overcome these issues. The liquid form has been converted to readily soluble granules (54) maintaining the same efficacy as freshly prepared decoction with the

help of modern technology. These are available in a single dose pouch of 2 gms each. The ingredients are granulized, micronized and standardized to develop consistency and maintain the efficacy. The granulated form is easy to use with advantages of elimination of leakage or breakage.

Discussion

Size of Drug

Acharya Charaka has clearly indicated that raw drug should be cut into pieces for the preparation of decoction.(19) It must be emphasized that the very high degree of size reduction is not preferred because an extensive size reduction is likely to lead to decomposition of the constituents or loss of volatile material. The degree of size reduction will also depend on the botanical structure of the drug. *Yavakuta*- coarse powder size is ideal for preparation of the decoction. Presently it is observed that 60-100 mesh size crude herbs are used for preparing a decoction.

Importance of Soaking

Soaking enables the dried drug to become porous, thus allowing the solvent to penetrate the cells. This process is dependent on the character of the drug. The cell walls consist of cellulose molecules known as micelle. In the fresh material, they are surrounded by a film of water. After drying, the film is lost, and the micelles move together to form a continuous membrane. When the dry ingredients are moistened, the process is reversed, and the micelles takes up a liquid film and tissues swell up. The amount of swelling is variable. Swelling is observed more with liquids, those having hydroxyl groups form a great part of the molecule which is why water causes considerable swelling. Hence, it is advisable to soak coarse powder of the ingredients in the water for some time.

Quantity of Water

It has been observed that the ratio of drug and water in decoction varies in different classics according to the consistency and quantity of the drug. The quantity of water and its reduction to prepare the final decoction depends upon its therapeutic use which may be internal, external or for the preparation of other dosage forms.

Quantum of Heat

Mrudu- mild heat (around 100°C) is applied to avoid *dagdha* and *picchila*- over burnt and sticky and to obtain *Samyakviryautkrishtata* (41) highly potent preparation. Scientifically, most of the alkaloids and other substances get deteriorated at high temperature.

Effect of Agitation

The rate of transfer of solute from the boundary layer to the surrounding depends on the concentration gradient between these two regions and on the thickness of the diffusion pathway. Agitation helps to increase a dissolution pathway. Also, bringing fresh solvent in contact with the boundary layer produces high value for the concentration gradient. It is envisaged that the rate of dissolution may markedly be affected by agitation or stirring.

Therapeutic Indications

Use of *kwatha* has been in practice since the *Vedic* period, which goes back to 1500 BCE. Since then *kwatha* or decoction, as it is better known today, has continued to hold its position as an important ayurvedic formulation which also continues to interest the modern pharmaceutical scientists. Part of the recognizable progress in the use of *kwatha* is its preparation as a polyherbal formulation. Polyherbal formulations have also been used since a long period of time in Ayurveda for the treatment of various disorders.

Kwatha Manimala describes about 394 *Kwatha* formulations used in various disease conditions. Ayurved Formulary of India mentions 25 *Kwatha churna*, which are useful in various disorders such as Fever, Retention of Urine, Diarrhea, Inflammation, Various types of gynecological disorders, Arthritis, Rheumatoid arthritis.(55, 56,57)

One such example is *Tila kwatha*, which is a polyherbal formulation. *Tila kwatha* has been prescribed for various menstrual conditions like *nastapushpata*- amenorrhea, *raktagulma*- composite enlargement due to vitiated blood (58). One more example of polyherbal *kwatha* formulation is *Vasaguduchyadi kwatha*. This is used for the treatment of *kamala* - jaundice, *panduroga* - anemia and such other liver diseases. The conventional allopathic medicines for liver diseases, in specific, fail to provide satisfactory elimination of the ailment. Synthetic drugs used for the treatment of such severe liver disorders show equally severe side effects because of which their use is limited (59). This is the reason why such polyherbal *kwatha* formulations not only persist but are also preferred by physicians.

Conclusions

Kwatha (decoction) is the potent therapeutic preparation in liquid form containing water soluble constituents responsible for therapeutic activity. Despite having high therapeutic efficacy, the use becomes formidable due to the cumbersome process, poor palatability and reduced stability. Efforts are being made to overcome these issues with the use of modern techniques like spray drying and development of dosage forms that could be used easily without compromising the efficacy. A comprehensive pharmaceutical research in this area is desirable.

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