

A CRITICAL REVIEW OF STANDARDIZATION OF AYURVEDIC ASAVA-ARISHTA PART I - REVIEW AND STATUS

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Article Received on
22 March 2016,

Revised on 12 April 2016,
Accepted on 01 May 2016

DOI: 10.20959/wjpr20165-6204

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ABSTRACT

Standardization of dosage forms as prescribed in traditional system of Ayurveda have been an area of academic, research, industrial and regulatory interests. It is essential to understand the basic principles of therapeutic relevance of these dosage forms while adapting to technological advances for continuity of its optimum clinical use. The *asava-arishta* are classical Ayurvedic pharmaceutical dosage forms that are easy to use and are frequently prescribed owing to better palatability, accelerated therapeutic action, enhanced efficacy in the treatment of several diseases and due to its long shelf life. These are liquid forms wherein therapeutic attributes are collectively extracted from raw natural ingredients through self-generated alcohol. This

review, as part I of the paper on standardization, provides elaborate information compiled from several Ayurvedic classical and few modern texts and critically analyze the principles applied in processes for preparations of *asava-arishta* preparations. This review highlights several salient features, particularly relevant to the fermentation process of this unique dosage form. It will help consider newer approaches, standards and technological methods for better acceptability and therapeutic applications.

KEYWORDS: Ayurvedic products, *Asava*, *Arishta*, Fermented medicine, QC of Ayurvedic products, Medicinal wines.

1. INTRODUCTION

Asava (fermented infusion) and *arishta* (fermented decoction) are dosage forms that are prepared based on *sandhana kalpana* (fermentation with self-generated alcohol).^[1] Fermentation is a process of preparing formulations wherein the therapeutic attributes of a group of ingredients are extracted from *swarasa* (freshly extracted juice of plants) or *kwatha* (decoction prepared in water) with the help of biochemical or microbial fermentation and anaerobic respiration into the liquid.^[2] In this process alcohol is generated by fermentation (not added from outside). These formulations therefore contain self-generated alcohol which facilitate longer shelf life, provide comparatively faster absorption and enhanced therapeutic efficacy in smaller doses.^[3] As many as 124 preparations are prescribed in Ayurvedic texts indicated for wide range of disorders.^[4]

1.1 Need for the Review of Ayurvedic Dosage Forms

Ayurveda emphasizes the use of scrupulous methods and meticulous applications of all the processes for preparing any kind of dosage forms. The classics provide precise guidelines for the use of specific raw material, accurate and technically correct processes for extraction of therapeutic attributes, exact therapeutic applications of particular dosage forms and several specific methods of administration of dosage form to the patients. These specifications make the Ayurvedic pharmaceuticals a science to be followed unerringly for achieving desired results. In order to ensure quality and safety of any dosage form, comprehensive knowledge of all these factors as described in Ayurvedic texts is essential. A comprehensive study and understanding of these forms will help to enumerate fundamental similarities and variances of traditionally prepared *asava-arishta* as compared to the use of modified methods and technology adaptation for present day production and efforts taken for standardization of *asava-arishta*.

2. REVIEW OF THE CLASSICS

2.1. Historical perspective

The knowledge of alcoholic drinks and fermentation techniques has been known to man since as early as the paleolithic age. The use of fermented formulations named *Sura* (strong distilled alcohol) and the *Somarasa* (juice of *soma*, the elixir plant), have been in the *Rigveda*, *Yajurveda* and *Atharvaveda* (ancient vedic texts) as divine offerings to God. (*Rigveda* - 6/66/10) The use of maple fruits, raw or cooked cereals and barks of specific trees for the preparation of fermented drinks have been described since the neolithic period as also in the

writings of the Egyptian scriptures.^[3] The progressive use of fermentation in making of alcoholic drink, wine and the medicinal formulations of *asava-arishta* can be traced chronologically from the vedic period to the *Samhita* period wherein *kithe*, the fermentation process has been elaborated from pharmaceutical and clinical or therapeutic viewpoints.

The major difference in the Ayurvedic application of these fermentation techniques and the use of these techniques in other regions of the world is in its clinical usage. Ayurveda describes the process of making *madya* (exhilarating drink) the liquid formulations prepared as per the principles of classical fermentation process that preserves the alcohol soluble extractives of herbal ingredients in self-generated alcohol. These are primarily used as medications for treating disease conditions while the fermentation techniques used in other parts of the world, especially the European countries for preparations of wine, beer or other alcoholic drinks have taken the customary forms being used for pleasure with limited medicinal value.^[5]

2.1.1. Vedic Period (1500 – 500 BCE):

Since the *vedic* times the fermented form of milk; the yogurt; acidic (mycobacterial) fermented product is commonly used as a part of nutritional dairy product.^[6] Vedic literature documents the use of wooden containers for the preparation of various fermented formulations like strong distilled alcohol and fresh juice of *soma*; the elixir plant. These ritualistic offerings to God were meant for human consumption.

The references from *Rigveda* and *Kautilya Arthashastra*, a medieval text indicate the use of fermentation techniques for the preparation of variety of formulations namely *Medaka*, *Prasanna*, *asava-arishta* from fruit juices and molasses with the use of *kinva*, *surabeeja* (microbial inoculums).^[7,8]

Use of fermentation methods for preparation of medications took regular form after vedic period. Use of a variety of ingredients and methods to develop medicaments with self-generated alcohol for different diseases became more prevalent. Use of different grains like barley and rice, fruits like grapes, juices of sugarcane and dates, honey and the flowers like *Dhataki* (*Woodiforida fruticosa*) and *Madhuka* (*Madhuca longifolia*) to initiate fermentation process are more evident in the texts of later period.^[9]

2.1.2. Samhita Period (300 -500 BCE)

Brihatrayi, triad of major Ayurvedic texts namely *Charaka Samhita*, *Sushrut Samhita* and *Ashtang Hridaya* describe pharmaceutical and therapeutic aspects of fermentation for two types, '*madya*' (wines) and '*asava-arishta*' in detail.

Charak Samhita states nine potential herbal sources for fermentation - *phala* (fruits), *dhanya* (cereals), *mula* (roots), *pushpa* (flowers), *twak* (bark), *sara* (exudate), *kanda* (branches), *patra* (leaves), and *sharkara* (sugar) are the examples.^[11] It also elaborately defines the fermentation process, method of preparation, specifications for the use of container, precise time required for fermentation, parameters for specific testing process, outcome of the product and therapeutic uses of finished product. *Charaka* credits *Soma* as '*Aushadhinam Shreshtha*' meaning best amongst all medicinal preparations and *sura* as '*Shramaharanam Shreshtha*' as the most refreshing drink.^[10]

Sushruta Samhita describes several fermented products for use during surgical procedures as anesthetics as well as medicines to treat different disease conditions.^[11] In addition to *asava-arishta* other fermented products like *madya*, *sura*, *prasanna*, *jagala*, *surasava*, *madhvasava*, *shukta* and *dhanyamla* are described in the category of *madya*, the exhilarating drinks.^[12]

Ashtanga Hridaya is first to describes use of flowers of *Woodfordia fruticosa* to initiate fermentation process for preparations of *asava-arishta*.^[13] *Draksha* (grapes), *ikshu* (sugarcane), *makshika* (honey), *shali* (rice) and *vrihi* (grains) are the five sources to prepare *madya*, the exhilarative drink as in *Ashtanga Sangraha*.^[14]

2.1.3. Compendia

'*Abhishava*', a fermented drink, is one of seven main dosage forms as described in *Kashyapa Samhita*.^[15] *Sharangadhara Samhita*, a medieval compendium of Ayurvedic formulations differentiates the *asava* and *arishta* as two different types of preparations. Accordingly, *Asava* are '*anagni siddha apakwaausddha*' meaning prepared with freshly extracted juice of plants or *heema* (cold infusion) where direct heat is not used at any stage of preparation. *Arishta* are prepared from decoction that requires *agni sannikarsha*, the direct heat for boiling of ingredients for the preparation. The *Chakrapani* commentary on *Charak samhita* confirms the same; *Sharangadhar* has clearly elaborated on differences between the preparations.^[16]

There is difference in methods of preparation of *asava* and *arishta* that obviously will contribute to its pharmaceutical properties and potency. *Bhavaprakasha Nighantoo*, another medieval pharmacopoeia text of Ayurveda describes fermented group, *sandhan varga*, of medicines and also differentiates *asava-arishta* as processed without or with direct use of fire respectively. *Sharangadhara* recommends *arishtas* to have potential for early absorption^[17] with *laghu guna*, lightness achieved due to direct use of fire in the process. Whereas the *asava-arishta* are prescribed formulations for medicinal purposes the term '*madya*' is referred for exhilarating (alcoholic) drinks which may or may not have therapeutic uses.^[18] An observation based on *Sushruta Samhita* reveals predominant use of liquid ingredients for *asava* preparation while solid ingredients for the *arishta* preparations.^[19]

Other compendia of Ayurvedic formulations like *Shodhala Nighantu*, *Raj Vallabh Nighantu*, *Nighantu Ratnakar*, *Raj Nighantu*, *Dhanavantari Nighantu* etc, of 18th and 19th century A.D. have also described *asava-arishtas* of various types. Several 18th or 19th century texts like *Bhaishajya Ratnavali*, *Sahasrayoga*, *Gada Nigraha* and *Yoga Ratnakara* have separate descriptions of *asavas-arishtas* for the treatment of a wide range of diseases.

3. DEFINITIONS OF TERMS

3.1. Sandhana (Fermentation)

From the etymological point of view, the term *Sandhana* means, *Sandhiyate Yena tat sandhanam - aneka dravya sambhaaro yena madyam yathavat pramanena sandhiyate*^[20]; which implies the excited amalgamation of several ingredients for the process of *madya utpaadanam*, developing exhilarant attributes. Thus, the term '*sandhana*' is used to denote fermentation process. In this process juices, infusions, decoctions and such liquid forms along with either medicines or food materials are preserved together for long duration to trigger the fermentation. These *Asava-Arishta*, *Sura*, *Varuni*, *Sidhu* preparations are categorized under '*Madya*' group and *Sauviraka*, *Tushodaka*, *Kanjika*, *Dhanyamla* under *Shuktha* group.^[21]

3.2. Asava

The term '*Asava*' has its etymological origin in the word '*asut – asutatvat asava*', which implies anomalous attributes as exhilarating. The word '*Asavan*' (*Amla sadhitam*) implies sour, the acidic nature of these preparations.^[22]

The term *asava* is defined by *Sushruta* as the medication which is prepared by mixing together different kinds of medicinal juices, decoction, jaggery (molasses) and flowers of

dhataki (*Woodfordia fruticosa*) in an earthen vessel buried deep into a heap of grains for flavoring and to initiate fermentation. Authors *Sharangadhar* and *Bhavamishra* define the *asava* as medications prepared with fermentation of *apakvaushadha siddha*, uncooked or raw grains or ingredients.^[23]

3.3. Arishta

The term '*Arishta*' is indicative of the long term use of these forms without any deterioration in their attributes or efficacy with the passage of time. *Asava-arishta* mature and retain their properties even after becoming old. The *Bhavprakash samhita* describes the *arishta* as formulations which are prepared with the use of *pakvaushadha siddha*; earlier prepared (cooked) medications like herbal infusions or decoctions.^[24] It is inferred that the fermentation process originated from concepts of dosage form, as *asava* from expressed juice or cold infusion and *arishta* from the boiled decoction.

4. SALIENT FEATURES

Asava-arishta are self-generated alcohol formulations wherein the therapeutic attributes are extracted through self-generated alcohol into a liquid dosage form.

- Several shortcomings with respect to administration of the five basic therapeutic dosage forms mentioned in Ayurveda (*Panchavidha kashaya kalpana*) are overcome with the use of *asava-arishta* formulations.^[25] These basic formulations include - *swarasa* (freshly extracted juice), *kalka* (fresh wet grind), *hima* (cold infusion), *phanta* (hot infusion), and *kwaatha* (decoction). All the five formulations are required to be used fresh and cannot be stored. The *asava-arishta* formulations being alcohol based have an indefinite shelf life, are more palatable than any of the other dosage forms and its alcohol content helps enhance the absorption and efficacy by extracting maximum conglomerate of active compounds.^[26]
- The process of fermentation extracts a wider range of active but compound ingredients, both alcohol soluble and water soluble ingredients than any other extraction method. Most unique property of these formulations is that the process of aging matures the formulation and enhances the efficacy.
- All the texts describe common attributes of these formulations as *vaatanashaka* (regulatory), *ushna* (thermogenic), *amlarasa* (sour), *pittakara* (aggravates pitta, inflammatory), *agnideepaka* and *paachaka* (digestive), *ruchikara* (appetizing), *tikshna*

(fast absorptive), *sukshma* (proliferative to minutest function in the body) and that which is capable of fast action.^[27]

- Specific attributes of different *asava-arishta* formulations depend on the ingredients of the formulation. These are prescribed for treatment of wide range of diseases from simple digestive ailments to the chronic afflictions caused due to the anomaly of *vaata dosha*. These formulations are indicated in diseases like *kshaya* (tuberculosis), *grahani* (chronic colitis), *pandu* (anaemia), *jvara* (fever), *kapha rog*, *vaata rog*, varying types of pain, *udara* (ascites) and *pliha* (splenic disorders).^[4]
- In the preparation of *asava-arishta* the fermentation process removes most of the undesirable sugars from plant material thereby making it bio-available and eliminating side effects such as flatulence and bloating.^[28]
- The process of fermentation while removing contaminants in the formulation also lowers the adverse effect of possible toxic components of the ingredients.
- Most importantly, in a tropical country like India such therapeutically active ingredients are made available throughout the year without seasonal interruptions.

Each formulation will require its own parameters of raw materials, quantity and the time for fermentation.

5. FERMENTATION PROCESS (*SANDHANA*)

Fermentation process, a pharmaceutical process of preparation of *asava-arishta* can be divided into three stages; first the preparatory stage, second the main procedure wherein all the drugs are mixed in specific sequence for fermentation and the third which covers finished product and storage.

5.1. Preparation

5.1.1. Collection of raw drugs

All the ingredients, crude herbal material of the formulation, after authentication, should be collected in required quantity and tested for quality and purity as per standards applied for raw material. Care should be taken to ensure that the raw materials are free from foreign matter and other residual contaminants or pesticides. This phase involves inventory of quantities required for the formulation and ideal storage conditions.^[29]

5.1.2. Selection of *sandhana patra* (vessels or containers)

The texts mention the use of earthen pots and wooden pots for fermentation process. Some other containers made of iron for *Madhvasva*^[30], of stone^[31] for *Kumariasava* and even of gold as for *Saraswatarishta*^[32] are also used. These classical containers have certain limitations such as earthen pots may break and wooden pots require pre-treatments as it affects the absorption of liquids. The use of metallic containers may initiate a chemical reaction with liquid ingredients. The use of steel or plastic containers was tested for the preparation of *asava-arishta*.^[33] The study concluded that the use of thermoplastic or steel containers can be considered safe for the production and storage of *asava-arishta*. However, the changes in the attributes and the therapeutic efficacy of the drugs prepared and stored in these containers as against the traditional method of storage needs to be studied and validated for its safe use. It is necessary to consider the porous quality of the earthen pots and the wooden containers that may have an important role on fermentation process with its exposure to outside air. The modern day technology of manufacturing wine which shows immense similarity with the *sandhana kalpana* also suggests the storing of wine in glass bottles sealed with wooden corks to encourage contact of the liquid with outside atmosphere and free exchange of gases. Furthermore, there is need to compare the effect and the relevance of the preparation process of *sandhana partra* mentioned in the texts while using thermoplastic or steel containers.

5.1.3. Preparation of *Sandhana Patra*

The vessel to be used for fermentation process has to be cleaned by the processes of *dhoopana* (medicinal fumigation) and *lepana* (coating or smearing the inner wall of the vessel with medicines).

5.1.3.1. *Dhoopana* – Fumigation process

The fermentation vessels are subjected to *dhoopana*, a process of fumigation to prevent the growth of naturally occurring microorganisms that may contaminate or hamper the process of fermentation. Molasses^[34] or powders of crude drugs like Indian valerian, *agaru* (*Aquilaria agallocha*), *chandan* (*Santalum album*), *marich* (*Piper nigrum*, Black pepper) and such are sprinkled on hot embers and burnt to fumigate. These crude drugs may contain volatile oils that have antibacterial, antiseptic action thereby providing a specific eco-system similar to present day sterilization procedures.

Table – 1: Raw drugs used for fumigation of fermentation vessels.

Sr. no.	Dhoopan Dravya	Formulations	Reference
1	Sharkara (Jaggery), Agarar (Aquilaria agallocha)	Kanakarishta	C.Ci 14/168
2	Mansi (Nardostachys jatamansi), Marich (Piper nigrum, Black pepper)	Ushirasava	Sh.S.(M). 10/13-17
3	Chandana (Santalum album), Agarar (Aquilaria agallocha)	Drakshasava	G.N. 6/160

5.1.3.2. Lepana – Smearing and Coating Process

The fermentation vessels are porous to outside air that may affect fermentation process. Process to smear and coat the inner surface of the fermentation vessel is prescribed to edge out such adverse effects. Ghee, honey or cow's urine are used as base with herbs like Pippali (long pepper) Chavya (Piper retrofractum), Priyangu (Callicarpa macrophylla) made into the form of paste that is smeared evenly to provide a coat on the inner surface of the fermentation vessel.^[35] Such a coat forms protective layer to prevent any unwarranted interaction between the fermentation material and outside air. Most ingredients used for smear have pungent or sharp attributes.

Table – 2 Ingredients Used to Smear and Coat Fermentation Vessel

Sr. no.	Drugs	Formulation	Reference
1	Pippali (Piper longum), Chavya (Piper retrofractum), Priyangu (Callicarpa macrophylla), Madhu (Honey), Sarpi (Ghee)	Dwitiya Phalarishta	C. Ci 14/155
2	Ela (Elettaria cardamomum), Mrunal (Lotus stalk), Agarar (Aquilaria agallocha), Chandan (Santalum album)	Madhukasav	C. Ci 15/148
3	Pippali (Piper longum), Madhu (Honey)	Loharishta	S. Ci 12/14
4	Phalini (Ficus heterophylla), Pippali (Piper longum), Chavya (Piper retrofractum), Madhu (honey), Sarpi (Ghee)	Duralabhasava	A. H. Ci. 8/71

5.2. Main Procedure

The unique feature of asava-arishta preparations is the appropriate method to mix and blend the ingredients to ferment and amalgamate with self-generated alcohol to develop a stabilized medicinal liquid dosage form at the end. The following steps are followed.

5.2.1. Developing a fluid base (ingredients in liquid form)

Different ingredients in liquid form like fresh juice or such required for the preparation of asava-arishta are acquired in the indicated quantity. The expressed juice or decoction are prepared as per the procedure mentioned in the texts. These are acquired in the required quantity in the vessel to be used for fermentation. Ushirasava,³⁶ is prepared with water; fresh juice is used for Dhatryarishta, Madhvarishta, Kumaryasav³⁷ and Vasarishta; herbal

decoctions are used for *Duralabhasava*, *Punarnavasava* and *Vasakasava* whereas *Chitrakarishtha*, *Gandeeerasava*, *Karpurasava*³⁸ and *Takrarishtha*³⁹ are prepared from cow's urine, cow dung, and buttermilk respectively. Sour gruel for *Abhayarishtha*^[40] and *Ksharajala*^[41] for *Palashasava* are examples of such variance. This variance indicates the deep knowledge about choice of liquid, the solvent in relation to therapeutic principle of main ingredient or the group of ingredients.

5.2.2. Sweet - *Madhura* ingredients as base for fermentation

Madhura, sweet ingredients are essential to provide base for fermentation. Molasses (jaggery), honey or sugar in specific quantities suggested are used as source of carbohydrates. The fermentation of ingredients in presence of sweet substances triggers and energizes bacterial growth and thereby fermentation of amalgamated mix. Hence, nature, quantity and quality of sweetening substances, the main source of energy for fermentation affect the rate of fermentation and quality of the final product. Sugar, molasses, juice of sugarcane or honey or any such sweet substance has unique bio-chemical attributes that will impact the process of fermentation. Molasses with presence of alkaline content help in faster fermentation unlike honey that may make it slower but sustained. Present day experiments have confirmed these variations with bacterial studies.^[42,43] Jaggery, molasses is used for *Kutajarishtha*^[44] and *Pippalyasava*^[47] and honey is used in *Vidangarishtha*.^[45] Combination of sugar and honey is used in *Usheerasava*^[36] and *Mrudvikarishtha*^[46] and honey with molasses is used for *Kumaryasava*^[37] and *Drakshasava*.

5.2.3. Ingredients to trigger fermentation and its enhancement - *Sandhan dravya*

Several flowers ferment naturally to generate microorganisms. Such flowers are used in these preparations to trigger the fermentation process. *Dhataki pushpa*, flowers of *Woodfordia fruticosa*, and *Madhuka pushpa*, flowers of *Madhuca longifolia*^[48] and now *sura beeja* (mother yeast) or *kinva* (microbial inoculums)^[49] are commonly used to initiate and enhance fermentation. For example, 8 *pala* (320 grams) of *Woodfordia fruticosa* is used in *Kumaryasava*^[37], 10 *pala* (400 grams) for *Pippalyasava*^[47], 16 *pala* (640 grams) for *Devadarvyarishtha*^[50], 20 *pala* (800 grams) in *Lohasava*^[51], 30 *pala* (1260 grams) for *Dashmoolarishtha*^[52] and 1 *prastha* (640 grams) for *Mrudvikarishtha*^[46] (1 *Pala*: 40 Grams & 1 *Prastha*: 640 Grams).

5.2.3.1. Use of Bran - *Surabeeja* / *Kinva*

The residue obtained after the filtration of the final product of the fermentation called *surabeeja* or *kinva* is dried and stored for further use. *Kautilya arthashastra*, a text by famous *Chanakya* elaborates on the process of preparation of *kinva* from raw and cooked grains of Masha, the black gram, rice and *Morata*, a dairy product. It is advised to use the same *surabeeja* of one particular type of *asava* or *arishta* every time for consistency of quality. Use of *kinva* from a different type of grain in a formulation will alter the taste and attributes of the formulation.

5.2.3.2. Use of Yeast

The inoculum to initiate the process of fermentation comes from the flowers that have wild species of yeast. It is observed that flowers of *Woodfordia floribunda* initiate alcoholic fermentation in preparation of *asava-arishta* which is similar to achieved with the use of pure yeast cultures. These flowers were found susceptible to enzymatic conversion to alcohol in anaerobic respiration. The study also concluded that the use of *dhataki* flowers while undergoing fermentation helped in extraction of biologically active compounds in the self-generated alcohol, thereby enhancing the clinical efficiency of the drug.^[53] It also inferred that the alcohol provided the immunity against or resisted the growth of any other micro-organism in the formulation for years.

5.2.4. Significance of Additives - *Prakshepa dravya*

Prakshepa dravyas are ingredients added after the main process of preparation is over. These ingredients are added to enhance the therapeutic effect or to contribute to taste or aroma or even as a colorant. These additives can be in the form of powder or liquid. These include fine powder of ginger or different varieties of Piper in combination referred to as *triaktu* – three-pungent, or *panchakola* to enhance the therapeutic activity or coarse powder of aromatics termed *sugandhi dravya* like natural camphor or musk. Fine powders of *Bhasma* or metallic preparations are added to provide specific therapeutic attributes to the *asava-arishta* preparations as *makshika* (copper pyrite) containing iron in *loharishta*^[54], *suvarna* (gold) in *Saraswatarishta*^[55] and *loha* (iron) in *Lohasava*.^[56] Research has shown some microorganisms capable of consuming metals under optimal or specified conditions, fermentation might be one such condition. Enhanced iron content in *lohasava* is confirmed with the addition of fine *loha churna* – iron powder which gets converted into minute particles by the action of alcohol, thus increasing the bioavailability of the ingredient.^[57]

Addition of fine powders of metals is the common method while, heating and dipping of metal plates in liquid ingredients prepared for fermentation process also forms an important way of instilling the attributes of the metal into the formulation. Different texts suggest different days to add these ingredients as 1st, 4th, 5th day during or after the completion of the fermentation. Methods of putting in additives also vary as per requirement of the preparation. A mini bag, *pottali* containing ingredients is added into the formulation to provide therapeutic flavors. In some cases, additives are added or spread over wort in the form of a paste followed by homogenous mixing to facilitate exchange of air or oxygen at the beginning of the fermentation thereby restrained growth of micro-organisms for proper fermentation.

5.2.5. Filling and sealing of *Sandhan patra*

The texts advice that only three fourth of the container should be filled with liquid ingredients, the remaining one fourth is left for the accumulation of gases released during fermentation process. This unfilled space shall provide room for frothing and release of gases during the process of fermentation.

5.2.6. Storage conditions for fermentation - *Sthanavimarsh (Desh Samskara)*

The sealed vessels containing material under fermentation is ideally kept in a place with minimum temperature deviation. This is achieved through putting containers (vessels) in a heap of grains – *dhanya rashi* as for *Kanakbindu arishta*,^[58] or buried in the earth of *bhugarbha*, *chaulyagara (kharjurasava)*^[59] *koshthasara (kumaryasava)*.^[60] The fermentation, the bacterial growth for fermentation, being light sensitive the direct contact of light and air is inhibited during the storage. The variance in time, storage and such traditional practices this recognize the needs of specific micro-organism for specific temperature for optimum growth and product formation. Generally, the optimum temperature required for fermentation is between 20°C-35°C.

5.2.7. Season, Time and Duration (*Sandhana Kala*)

Duration for fermentation process is suggested based on *desh*, the topography, *ritu*, the season and the *dravyas*, the type of ingredients. The cold, winter season require a couple of weeks more for completion of fermentation than in summer, the hot season which may take only a week or two. The right storage of vessels helps optimize fermentation time. Normally the fermentation process comes to an end by itself when the alcohol concentration of liquid reaches the concentration of around 12-14% as estimated now. *Sharangadhara Samhita*

suggests that the ferment can be kept for maturation for specific period as prescribed to enhance the therapeutic attributes of the formulation.^[61]

Duration of fermentation process varies from 3 days to 6 months depending on the main or group of ingredients. It may vary from 3 days for *Avratakyasava*^[62], 7 days for *Vasarishta*^[63], 30 days for *Punarnavadyarishta*^[64], 45 days for *Aragwadharishta*^[65] and 6 months for *Guggulasava*.^[66]

Following observations are relevant for fermentation process.

Table –3 Observations Relevant to Process of Fermentation

Observation	Initial stage of Fermentation	During Fermentation	On Completion of Fermentation
Additives	Floats on the surface	Floats on the surface	Sinks Completely
Effervescences	No evidence of effervescences	Presences of Effervescence with bubbling sound	No evidence of effervescences
Alcohol	Absence of alcoholic odor	Mild alcoholic odor	Presence of Alcoholic Odor
Burning candle	Extinguishes if taken inside the container	Extinguishes if taken inside the container	Candle continues to burn when taken nearer to the fermented media (due to presence of alcohol which acts as a fuel)
Viscosity	Higher than water	Higher than water	Higher than water
Temperature	Constant	slightly raises by 1-2°C	is reduced to near about 32°C
Lime water test	Appearance of bubble	Appearance of bubble	No changes

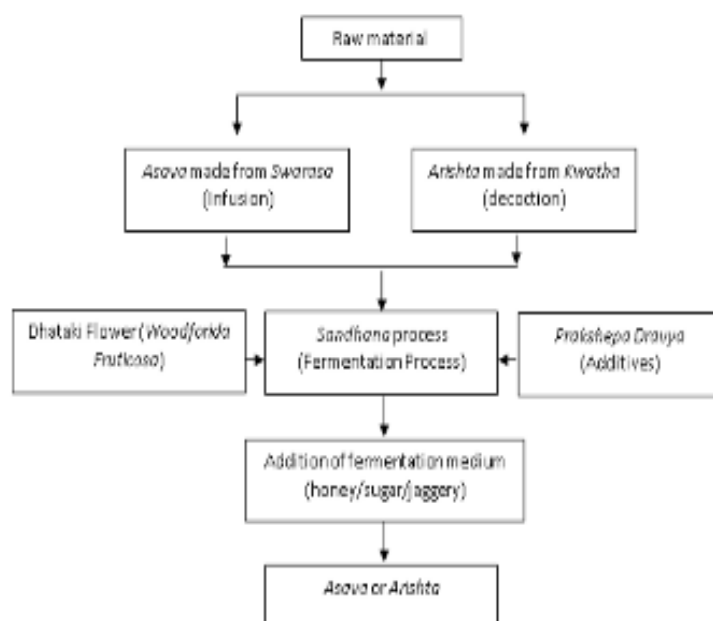


Fig. 1 Flow chart for process of preparing asava-arishta

5.3 Finished product

Jaatarasam in Sanskrit denotes completion of fermentation to form *asava-arishta* having total attributes.^[67]

5.3.1. Filtration of *asava-arishta*

On completion of fermentation process the liquid mass is filtered through double layered clean cotton cloth to separate the sediment. If required, the filtrate is allowed to stand for few more days and again filtered to ensure the separation of sediments.

5.3.2. Cleansing, *Nirmalinikaran of asava-arishta*

At times the coarse powder of *Kataka* (*Strychnos potatorum*) is spread on top of the filtrate to absorb the remaining sediments and to get clean final liquid product. This cleansing process is termed as *Nirmalikaran*.^[68,69]

5.3.3. Storage

Asava-arishta are stored in dark colored vessels to avoid direct exposure to light.

5.3.4. Dose

Sharangdhara Samhita has prescribed the dosage of *asava* or *arishta* to be 1 *Pala* (= 48ml) along with equal quantity of water.

6. FAILURE IN THE PREPARATION OF ASAVA-ARISHTA

End product flaws may be seen in some of the fermented products which may be due to several environmental factor like failure due to change in the temperature, weather, due to sweetening substance or by reaction with the containers. Method to overcome the failure are mentioned below in the table.

Table – 4 Expected failures in the preparation of *asava -arishta*

Problems	Solutions
No onset of fermentation	Fermentation process takes place in hot conditions
Acidic fermentation	Prevented by adding <i>Shankha bhasma</i> (Ash made of Conch shell) or lime water or <i>Kshara</i> (Potassium carbonate, impure).
Fungal growth	It can be used after filtration and heating up to 60°C
Spoiled taste	Spoiled taste may be corrected by addition of honey or sugar
Low percentage of alcohol	Addition of sweetening agent or inoculum (Yeast or <i>Woodfordia fruticosa</i>) will increase the alcohol concentration
Spoiled color	Sugar should be fried and added when it becomes red
<i>Amla</i> (Sour) test	<i>Acharya Siddhinandan Mishra</i> has advised to add 10 grams of <i>Shudha tankana</i> (detoxified Sodium borate) and 250 grams of

jaggery in 1 liter of <i>asava-arishta</i> (<i>Madhurikaran</i> , fermentation with sweeteners) and again kept it for 8 days. <i>Surya Kshara</i> (<i>Potassium nitrate</i>) is also used ^[70]
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7. DISCUSSION AND LARGE SCALE PRODUCTION

Presently, the Ayurvedic industry manufactures the *asava-arishta* preparations in multiple of thousand liters. In large scale production the powdering, grinding and mixing are done by mills, pulverizes and mixing machines respectively. The decoctions are prepared in large steam jacketed boilers. The fermentation is carried out in huge airtight wooden vats with wooden covers or fermented in huge steel vessels. Yeast is directly added to trigger and accelerate the process of fermentation. The filtration is carried out by electric filter press with filter sheets that efficiently separate the suspended particles and isolate clear liquid.

The *asava-arishta* produced as per the traditional method takes 45-90 days and has alcohol content quite low, not more than 5-6%. In traditional method all the ingredients are put together including the comparatively high sugar base right from beginning thereby compelling the much prolonged fermentation process to achieve inhibition of the bacterial activity to achieve the completion. The addition of additives in the beginning, which often contain volatile oil bearing ingredients, also has an inhibiting action on fermentation.

In large scale production low concentration of sugary material (about 12-13% of the total proportion mentioned) is added with the fermenting medium. When the desired alcohol content in the formulation is achieved, about 12% attainable in a period of 4-5 days, the remaining quantity of sugary or sweet ingredients required by the formula are added along with the additives and preservatives like sodium benzoate.^[71] When the absorption of the active ingredients of the additives by self-generated alcohol is complete and the additives settle down at the bottom of the vessel, which normally take place in 7-8 days, the *asava-arishta* are ready for filtration and bottling. The total time period required by this method will be 16-20 days which is less as compared to 45-90 days required by the traditional process. It is also stated that the product, because of its higher alcohol content, will contain more of extractable attributes of the additives and its shelf life shall also be much longer. However, these claims are questioned by some practitioners who observed non-compliance of patients due to acidity after administration of *asava* or *arishta* prepared in this fashion.

Modification of technology which would enhance the production of formulations in larger batch sizes, producing high yields with least possible expenses is the need of the hour.

However, it is also important to maintain the therapeutic and compliance attributes of the formulations as per Ayurvedic parameters. Ayurveda formulated the concept of fermentation process with an aim to extract the water soluble as well as the alcohol soluble active principles of drugs into a formulation. The pharmacological science considers these bioconversions particularly beneficial for enhancing the therapeutics with the supplementation of alcohol, increasing the bioavailability and decreasing the toxicity of the drugs.

8. CONCLUSION

Asava-arishta represent unique concept and forms of classical Ayurvedic pharmaceutical dosage forms wherein microbial transformation helps in initiating the process of generating alcohol to extract the therapeutic attributes of a group of natural ingredients and enhancing its bioavailability. *Asava-arishta* dosage forms help the collective transformation of multiple phytochemicals having therapeutic attributes present in a group of raw ingredients to provide safe, potent and easy to administer liquid form with prolonged shelf life. The proficiency of Ayurvedic knowledge, traditional processes developed based on deep understanding of natural product behavior and adaptability to contemporary needs are evident in these forms. Several points of significance emerged of this critical review that could be of help to further its development and therapeutic utility. Standardization is necessary for present day manufacturing. This critical review helps understand sensitive issues and their significance in preparation of *asava-arishta*.

ACKNOWLEDGEMENTS

We are thankful to Ms. Smita Nimkar for her initial assistance and Dr. Vandana Kozarekar for her academic suggestions.

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