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Research Article

Malt Vinegar

Physico Chemical Analysis of Souviraka (Malt Vinegar) - An Acidic Fermentation

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Sandhana Kalpana is one revolutionary innovation evolved since the Vedic period owing to its better absorption and hence faster action, increased palatability and longer shelf life. Souviraka is one important classification of Sandhana Kalpana described in various treatment modalities.

Aim: Preparation and Physico chemical analysis of Souviraka (Malt vinegar).

Material and Methods: A thorough review of Souviraka from Ayurvedic texts along with in-depth analysis of published literature in various Databases/Journals related to Souviraka.

Result: Souviraka is an acidic fermentation which is white in colour thick liquid, sour acidic in taste, with unpleasant smell. Physico chemical study shows pH 3.43, Specific gravity 1.0336, Total soluble solids 82.40 and Refractive index of 1.3457. Chemical tests show Total acidity 1.60, Total soluble solid 9.64. Alcohol, and reducing sugars were found to be absent. Other test like Flame test was negative but Bubble test and Sink test were positive initially but later on it became negative. The Phyto-constituents evaluation shows presence of Alkaloids, Carbohydrate, Proteins but absence of Steroids, Phenols and Tannins.

Conclusion: Souviraka is a highly acidic fermentative product used in Ayurvedic management in the form of ingestion, local application and as Anupana (adjuvant).

Keywords: Acidic fermentation, Malt vinegar, Physico chemical analysis, Souviraka

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Introduction

Sandhana Kalpana is broadly divided into *Madya Sandhana* (Alcoholic fermentation) and *Shukta Sandhana* (Acidic fermentation).**[1]** *Souviraka* is a fermented preparation of boiled *Yava* (*Hordeum vulgare* L.) or *Godhuma* (*Triticum aestivum* L.).**[2]** According to many Ayurvedic texts, *Souviraka* is one of the types of *Shukta Kalpana* including others like *Tushodaka* (cooked hulled barley), *Shukta*, *Chukra*, *Kanjika* (Vinegar), *Sandaki*.**[3]**

In *Sharangdhara Samhita*, *Souviraka* and *Tushodaka* are said to be the types of *Kanjika*.**[2]** The probable explanation behind this could be that both are prepared by using drugs of similar group i.e., *Dhanyavarga*. *Souviraka* is an acidic fermentation prepared by boiling of *Nistushayava* (de-husked barley) or *Godhuma* (wheat corn). It approximately takes 6 to 7 days for the completion of proper fermentation depending on temperature.**[4]** The present work focuses on preparation as well as Physico-Chemical evaluation of *Souviraka*.

Materials and Methods

Preparation of *Sauviraka*: *Yava* were collected from the local market of Delhi. Identification and authentication were done in the Department of Dravyaguna, All India Institute of Ayurveda, Delhi. *Sauviraka* was prepared by following classical guidelines.**[5]** Accordingly, 1 kg of *Nistush Yava* was taken. Foreign particles were removed manually followed by washing of *Yava*. It was soaked overnight. Next day, 8 litres (8 times to that of *Yava*) of water was added to the *Yava* and boiled till it reduced to 4 litres (1/2th). Fermentation was carried out in porcelain jar. The jar was properly washed with hot water and then dried.

After that *Dhoopana* (fumigation) was done using *Guggulu* (*Commiphora mukul* L.) to prevent any microbial contamination. After proper pre requisition of *Sandhana Patra*, the boiled *Yava* was poured inside the jar, mouth of the jar was properly sealed with the lid and left undisturbed for fermentation. After 10, 20 and 30 days, the jar was opened to check for the presence of signs of fermentation like flame test, bubble test, fungus growth and floating test (Table 5). The prepared *Sauviraka* was filtered after 30 days through a clean muslin cloth and stored in an airtight container.

Analysis of *Sauviraka*:

Prepared product was analysed for organoleptic characteristics like colour, taste, odour, consistency. (Table 2), physicochemical tests like specific gravity,**[6]** total solid content,**[7]** Total Ash,**[8]** pH,**[9]** refractive index,**[10]** Alcohol,**[11]** (Table 3). Chemical tests for the presence of total acidity,**[12]** total soluble solids**[13]** and reducing sugars**[14]** (Table 4) were also performed. Presence of phyto-constituents like alkaloids, carbohydrate, reducing sugar, flavonoids, saponins, tannins, proteins, glycosides, Phenols, Amino acid, Terpenoids were also performed for 30-day sample. (Table 6)

Results

The fermentation process began on seventh day and was ceased in 30 days. The initial organoleptic examination shows that *Souviraka* was white in colour. As fermentation continued, it became milky white in colour, sour in taste, thick in consistency with typical unpleasant smell. (Table 2)

The physico-chemical analysis shows that *Souviraka* is highly acidic in nature with pH decreasing from 8.08 at 0 day to 3.75 on 20th day which decreased to 3.43 on 30th day. The total solid content was computed to be 37.33% on 0 day, becomes maximum i.e., 81.77% on 20th day and 82.40% on 30th day. Specific gravity increased from 1.0348 at 0 day to 1.0348 on 20th day and decreased to 1.0336 on 30th day, refractive index was 1.3331 at 0 day which increased to 1.3438 on 20th day and 1.3457 on 30th day. Absence of alcohol was observed from beginning till end. (Table 3)

In chemical parameters, total acidity was found to be 0.14 at 0 day which increased to 0.75 and 1.60 on 10th and 20th day respectively while it slightly decreased on 30th day to 1.56. Total soluble solids were found to be 1.52 at 0 day. It significantly increased to 9.12 on 10th day and 9.64 on 30th day. Reducing sugars was not found at 0 day while it was found to be 3.36 on 10th day, 2.93 on 20th day and it was found absent again on 30th day. (Table 4)

Among other observations, bubbles were absent in later stage, Flame test was negative throughout and no fungal growth was seen during the entire preparation. (Table 5)

The Phyto-constituent evaluation on 30th day showed that *Souviraka* has presence of alkaloids,

Carbohydrates, flavonoids, saponins, terpenoids and proteins along with amino acids. While Reducing sugars, tannins, steroids, glycosides and phenols were absent. (Table 6)

Table 1: Classical references of *Souviraka*

SN	Texts	Mentioned in
1.	Charaka Samhita	▪ Virechana dravya[26] ▪ Amla Skandha[27] ▪ Parisheka[28] ▪ Lepa[29] ▪ Anupana[30] ▪ Avgahana[31] ▪ An ingredient of Chitraka Ghrita[32] ▪ An ingredient of Panchamuladi Ghrita [33] ▪ In Vataja Hridroga[34] ▪ An ingredient of Triphaladi Mahasneha[35] ▪ In Vata Avruttasneha Janita Roga Chikitsa[36]
2.	Sushruta Samhita	▪ Method of preparation[18] ▪ Amla Varga[37] ▪ In Andhaputana[38] ▪ In Vataja Gulma[39] ▪ In Shwasa[40]
3.	Ashtanga Hridya	▪ An Ingredient of Panchamuladi Ghrita[41]
4.	Ashtanga Sangraha	▪ Similar properties like Kanji.[19] ▪ In treatment of Udara Roga[42] ▪ An ingredient of Pippalyadi Ghrita - in the treatment of Parigarbhika.[43] ▪ In treatment of Pilla Vyadhi[44] ▪ In treatment of Madatyaya[45]
5.	Chakradutta	▪ An ingredient of Shunthyadi Ghrita[46]
6.	Sharangdhara Samhita	▪ Type of Kanjika[2] ▪ Method of Preparation[2]
7.	Kaiydeva Nighantu	▪ Properties of Souviraka[20]
8.	Raj Nighantu	▪ Properties of Souviraka[21]
9.	Madanpal Nighantu	▪ Properties of Souviraka[22]
10.	Bhava Prakash	▪ Properties of Souviraka[23]

Table 2: Organoleptic characteristics

SN	Parameters	Days			
		Initial	10	20	30
1.	Roopa (Colour)	White	White	Dusky white	Dusky white
2.	Rasa (Taste)	Sweet	Slightly bitter	Sour	Sour acidic
3.	Gandha (Odour)	Pleasant	Pleasant	Unpleasant	Unpleasant
4.	Sparsha (Consistency)	Thin Liquid	Thin Liquid	Thick Liquid	Thick Liquid

Table 3: Physico-chemical tests

SN	Parameters	Days			
		Initial	10	20	30
1.	Specific Gravity	0.9993	1.014	1.0348	1.0336
2.	Total Solid content (%)	37.33	62.11	81.77	82.40
3.	Total Ash (%)	0.054	0.198	0.085	0.113
4.	pH	8.08	4.04	3.75	3.43
5.	Refractive index	1.3331	1.3452	1.3438	1.3457
6.	Alcohol	Absent	Absent	Absent	Absent

Table 4: Chemical tests

SN	Parameters	Days			
		Initial	10	20	30
1.	Total acidity	0.14	0.75	1.60	1.56
2.	Total soluble solids	1.52	9.12	8.78	9.64
3.	Reducing sugar	Nil	3.36	2.93	Nil

Table 5: Other tests

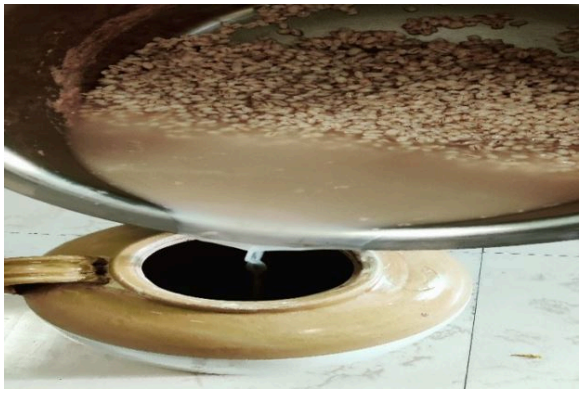
SN	Parameters	Days			
		Initial	10	20	30
1.	Flame test	Flame continued to burn	Flame continued to burn	Flame continued to burn	Flame continued to burn
2.	Bubble test	Absent	Small	Small+	Disappear
3.	Float/sink test	Floating	Floating	Floating	Sink
4.	Fungal growth test	Absent	Absent	Absent	Absent

Table 6: Phytoconstituent evaluation

SN	Phytoconstituents	Name of test	Observation
1.	Alkaloids	Mayer's test	+
		Hager's test	+
		Wagner's test	+
2.	Carbohydrate	Molish's test	+
3.	Reducing sugar	Fehling's test	-
4.	Flavonoids	Alkaline reagent test	+
		Lead acetate test	+
5.	Saponins	Foam test	+
6.	Tannins	Braymer's test	-
7.	Steroids	Salkowski' test	-
8.	Proteins	Millon's test	+
9.	Glycosides	Keller Killiani's test	-
10.	Amino acid	Ninhydrin test	+

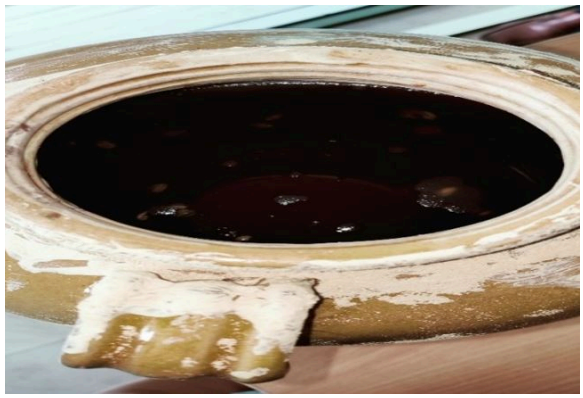
1 kg of Nishtusha Yava is taken

Boiling of Yava



Transfer Boiled Yava into Porcelain Jar

Porcelain Jar kept undisturbed



Fermentation process

Flame test after 10 days

Flame test after 20 days

Stored in an Air tight container

Discussion

India's annual production of barley is around 1.6-1.8 million tonnes and area under cultivation stabilized around 0.65-0.70 million hectors.**[15]** Many studies have proven that regular intake of barley which contains fibres and different phytochemical can reduce risk of heart disease, colonic cancer, hypertension, gallstones and also improves strength of immunity. Barley contains both soluble and insoluble fibres, protein, vitamin B and E, flavonoids, anthocynins, minerals i.e., selenium, magnesium, iron, copper.**[16]** *Souviraka* is an acidic fermentation which can be considered as acidic extract of barley. Ancient researchers were well versed about benefits of barley so for its proper and long-term use, they prepared its *Amla Sandhana*. It can be used both as a nutritive product as well as to prevent and cure diseases. *Souviraka* has longer shelf life and is said to be better when old. About 11 references of *Souviraka* are mentioned in *Charaka Samhita*. According to *Charaka*, both *Souviraka* and *Tushodaka* acts as *Hrudroga Nashaka* (pacify heart disease), *Pandu Nashaka* (pacify Anemia) etc. but these two are also mentioned separately in different therapeutic indications.**[17]** *Acharya Sushruta* has explained slightly different method of preparation. He has used *Trivruttadi Gana*, *Vidarigandhadi Gana* and *Brihata Panchamula* in preparation of *Souviraka*.**[18]** *Acharya Vagbhatta* in *Ashtang Sangraha* has mentioned that properties of both *Souviraka* and *Tushodaika* are similar to that of *Dhanyamla* or *Kanji*. These pacify *Krumiroga* (Helminthic diseases), *Hridyroga* (heart disease), *Gulmroga* (Abdominal lump), *Arshroga* (Piles) and *Panduroga* (Anemia).**[19]** *Acharya Sharangdhara* has mentioned both *Souviraka* and *Tushodaka* as types of *Kanjika*. Also, *Souviraka* is advised to be prepared from dehusked barley.**[2]** *Kaiydeva Nighantu* has narrated properties of *Souviraka* like *Bhedana* (Purgative), *Gulma*, *Arsha*, *Kapha nashaka* and is said to be beneficial in *Udavrta* (Upward movement of gasees), *Angmarda* (Body ache), *Asthishula* (Ostealgia) and *Aanaha* (Gaseous distension of abdomen).**[20]** *Souviraka, Souviramla* and *Godhuma* are all synonyms according to *Raj Nighantu*. While describing properties of *Souviraka*, this *Nighantu* has described *Souviraka* as *Amla Rasa* (Sour in taste)*, Keshya* (nourishing hair)*, Mastak-Doshajita* (Mental disorder)*, Jara-Shaithilayahara* (Geriatric weakness)*, Bala-Santarpan Param* (Energy booster).**[21]** *Madanpala Nighantu* has described *Grehanihara* (Malabsorption syndrome), *Arshoghana*, *Bhedana* and *Agnideepaka* (improves digestion) properties of *Souvirika*.**[22]** *Acharya Bhavmishra* has mentioned both preparation as well as properties of *Souviraka*. Acc. to him, fermented liquid preparation from riped or unriped dehusked barley is known as *Souviraka*. It has described similar properties to that of *Kaiydeva Nighantu.***[23]** Wide applicability of *Souviraka* can be assessed as it is mentioned as an ingredient of many formulations, as *Anupana* as well as a local applicant by different seers in our Classics. (Table 1) It is evident that *Souviraka* has vivid applicability as it is indicated in many diseased conditions such as *Jwara*, *Udara Roga*, *Kushtha* etc., also used as an ingredient in few formulations**[24]** and also as an external applicant.**[25]** It mostly pacifies *Vata* and *Kapha Dosha* and has *Deepana* and *Shramahara* properties. In the present work, *Souviraka* was prepared by following reference of *Sharangdhara Samhita*. Although, as mentioned in classical texts that it takes 6-7 days for completion of process,**[4]** however, in present work it was observed that considering acidic nature of formulation, a stable pH below 4 was considered as end point for completion of fermentation process. Most of reported Ayurvedic acidic fermented products have a pH ranging between 2 -3 while after 6 months of observation pH of *Souviraka* 3.37. The smell, taste and odour observed at end of process are strongly suggestive of acidic fermentation. Degradation of carbohydrate and conversion into primary and secondary by-products may be possible reason behind colour change. This is also evident from changes in perception of taste, odour, consistency, pH and specific gravity. The consistency was formed due to viscous component i.e., fibrous part present in *Yava*. In acidic fermentation, there is formation of acetic acid which makes *Souviraka* strongly acidic and amount of acetic acid formed can be assessed by determining Total acidity value. Total solid content indicates components of *Yava* which are extracted in acidic medium and Total soluble solid shows amount of drug that is soluble in acidic medium. It was observed that Reducing sugars which were absent at beginning of process, were tested positive at 10th and 20th day of fermentation and later on, it became negative at 30th day. As, Barley is a rich source of Carbohydrates which further breaks down into Disaccharides (Maltose, Sucrose & Lactose) & Monosaccharides (Glucose, Fructose, Galactose).

Saccharides or Sugars can also be categorised as reducing or non- reducing. Reducing sugars including maltose, lactose, fructose and glucose are further converted into ethanol, then to acetaldehyde and finally to acetic acid. This explains the changing values of reducing sugars throughout the process, from appearing to being absent at the end of the process due to its conversion into acetic acid. Thus, the absence of reducing sugars indicate the completion of the acidic fermentation. Also, non-reducing sugar like sucrose which is a is not broken down further and explains the presence of carbohydrate in the sample.

The Specific gravity was little bit more than water which suggests that they are partially soluble in water. The increasing values of Refractive index show that the amount of drug was gradually extracted in liquid with the increasing duration.

In Flame test, flame of match stick at earlier stage was increased which may be due to acid formation. The Bubble and float test were seen positive in initial stage but later turns negative. The fungal growth was not seen in the whole process which is strongly suggestive of acid formation.

Also, the Phyto-constituent study revealed that *Souviraka* contains alkaloids, carbohydrate, proteins, amino acids and flavonoids with absence of steroids, reducing sugars, phenols and tannins.

Conclusion

Souviraka is an acidic fermentative product i.e., Malt vinegar with 1.60 % acetic acid. It can be administered in the form of ingestion, local application as well as a vehicle for many drugs. The prime object of the present study was to prepare and establish physico-chemical parameters of *Souviraka* so that it can be used further in various pharmacological procedures mentioned in the classical *Ayurvedic* literature. *Souviraka* can be used both in daily diet owing to its nutritional purpose and also for treatment purposes. It is highly rich in carbohydrates, alkaloids and proteins.

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