

Validation of *Yavakshar* Preparation- An Ayurvedic Alkaline Formulation

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ABSTRACT

Kshar is one important treatment paradigm emphasized by ayurveda. *Kshar Kalpana* (ayurvedic alkali formulation) is a formulation made of alkaline substances of the plants. The preparation in the study used five sequential procedures i.e. 1. Open Burning, 2. Maceration of white ash with specific quantum of water, 3.Sedimentation 4. Filtration and 5.Evaporation of Filtrate. Validation is needed at the level of each unit operation with scientific data. Here an attempt is made to generate scientific data on five procedures with different proportion of water used for dissolution of alkaline material. Many variants of the procedures are available in literature. *Yavakshar* is a commonly used *kshar* with lot of adulteration due to raw material scarcity. So *yavakshar* was taken up as representative to validate the process used in *kshar kalpana*.

Key Words: *Yavakshar*, Validation, *KsharKalpana*, Ayurvedic alkaline preparation

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Introduction

Ancient ayurveda scholars have formulated different drug preparations to achieve desired therapeutic actions quickly from small dosage¹ without producing other undesired effects². The process of making such formulations involved crude extraction³, dependent upon the nature and solubility of active components from plants to achieve desired action. *Mashi* (black colored formulation prepared through incomplete oxidation) and *Kshar Kalpana* (white colored residue obtained after evaporation of filtrate of plant ash dissolved in water) is mainly prepared to get carbon dominant organic material⁴, and alkali dominant material⁵ respectively from plants by using open and close burning of plant material. *Kshar* is an important treatment method for its superiority over all surgical and parasurgical measures⁶. *Acharya Vagbhat* narrates that the diseases which are difficult to cure can be treated by *Kshara* therapy⁷. So there is a need to validate the process of *Kshar* preparation to ensure its quality .

Process standardization is needed to maintain batch to batch uniformity in large scale manufacturing by using latest technology. Validation substantiates the existing process by dividing it into step wise procedures and keeping the strict records of the operation. This data may help to do mechanical and automatized validation.

Kshar Kalpana is mainly prepared through five unit operations 1.Open pan burning 2. Maceration of ash with specific quantity of water, 3.Sedimentation, 4. Filtration and 5. Evaporation of filtrate.⁸ Ancient Ayurvedic literature reveals three different methods of *Kshar* preparation by varying the quantum of water, different sedimentation time and frequency of filtration. So there is a need to determine the best method of *Kshar* preparation considering these variables in mind .*Yavakshar* is commonly used *kshar* formulation to treat *shula*(pain), *anaha*(flatulence), *adhmana*(general tympanitis), *mutrakruccha*(difficulty in micturition), *kanthavikara*(diseases of throat) and *amlapita*(acid-peptic disorder)⁹. *Yavakshar* is prepared by using dried whole plant of *Yava* (*Hordeum Vulgare*

Linn). Mitra et al. worked on pharmaceutical and analytical aspect of *yavakshar* prepared by two methods.¹⁰

No work so far has been done on three different methods of preparation of *Yavkshar* by using dried whole plant with seed and without seed. Previous work identifies the presence of elements like Na, K, Cl but the crystalline structure of elements in the compound have not been identified.

As the seeds of *Yava* have good value as food, medicine and as raw material in the beverage industry, there is a need to identify the difference between *Yavakshar* prepared by using whole plant with seed and without seed. An attempt therefore is made to substantiate different processes of the *Kshar Kalpana* through validation of fixing variations in different unit operations.

Material and Method

Procurement and Authentication of Raw Material: The seeds of *Yava* (*Hordeum Vulgare Linn*) were procured from Eartha herbal Ltd. and authenticated by the Agharkhar Research Institute, Pune.

Harvesting of *Yava* Plant: (Image 1) Authenticated seeds of *Yava* (25 kg) were sown in the half acre land. Cow dung cake (natural) and 25kg of Urea (Chemical) fertilizers were used during harvesting of *Yava* crop. Three months were required for full growth of plant. The crops were removed along with roots after complete drying. The crop was further kept in shades till whole plants along with roots get completely dried. Dried whole plants were divided into two parts –whole plant with seeds and without seeds.

Preparation of Ash of *Yava* plant:(Image 2) 800 kg of whole *Yava* plant with seeds and 800 kg of whole *Yava* plant without seeds was spread in an open field of 10 x 10 feet area. small quantity of dried plant was initially burned using fire and subsequently the remaining quantity was added slowly into the fire to ensure complete burning. Whole plant except seed gets burned quickly and converts into white ash. The maximum temperature recorded during burning was 350°C. Total 4 hours were required for

burning. White ash was collected after self cooling.

Preparation of *Kshar jala*: (Image 3) *Kshar jala* was prepared by using 6¹¹, 4⁸ and 8¹²⁴ times of water for dissolution of alkaline material from ash into the water. Three batches of each method were prepared by using white ash prepared by using whole plant with seed (batch A, B and C) and without seeds (batch D, E and F). White ash was rubbed with water till the pH of water remains constant and allowed to settle for 12 hrs in Batch B and E.⁸ Immediate filtration was done in Batch A, C, D and F.^{11,12} The *Ksharjala* was obtained after filtration by using three folded cotton cloth.

Preparation of *Yava kshar*: (Image 4) *Yavakshar* was obtained by evaporating the water content from the filtrate (*Ksharjala*) in open rotating pan.

All samples from 6 batches were subjected to various analytical tests like pH, Ash Value, XRD, FTIR to find difference in physico-chemical properties.

Results and Discussion

Yavakshar is an alkaline formulation denoted under the umbrella of *Kshar Kalpana* by ancient scholars. Preparation of *Kshar* mainly involves white ash formation, dissolution of alkaline material in water and evaporation of water portion from the filtrate. Harvesting was done to maintain the genuineness of raw material and to calculate the yield percentage. Two batches of *Yava* whole plant with seed and without seed were used to make *Yavakshar* cost effective without altering the quality of *Yavakshar* as seeds can generate some revenue. 0.25 acre land able to produce nearly 90 kg seeds, this can generate revenue as it has good value in medicine and in the beverage industry. 92 kg (11.5%) and 80 kg (10%) of white ash was obtained from the whole plant of *Yava* with seed and without seed respectively. Presence of seeds yields more percentage of ash than without seed as seed may contain more percentage of organic material. Open burning of the crop will assure the formation of white ash due to complete oxidation. The details of *Ksharjala* preparation are given in Table 1.

Table 1. Details of observation made during the *Ksharjala* preparation

	Batch A	Batch B	Batch C	Batch D	Batch E	Batch F
White ash quantity	8 kg	8 kg	8 kg	8 kg	8 kg	8 kg
Water	48 lit	32 lit	64 lit	48 lit	32 lit	64 lit
Avg. pH of water	7.3	7.33	7.36	7.3	7.33	7.4
Avg. pH of <i>Ksharjala</i> after maceration	9.43	9.166	9.6	9.96	9.56	9.76
Time required for maceration till pH remain constant	2 hrs	3 hrs	3 hrs	2hrs	3 hrs	3 hrs
Time given sedimentation	Nil	9 hrs	Nil	Nil	9 hrs	Nil
Details of filtrate	3 folded cotton cloth	3 folded cotton cloth	3 folded cotton cloth	3 folded cotton cloth	3 folded cotton cloth	3 folded cotton cloth
Frequency of filtration	21 times	1 time	7 times	21 times	1 time	7 time
Avg. pH of <i>Ksharjala</i> after Filtration	9.43	9.166	9.6	9.96	9.56	9.76
Filtration time	6 hrs	1 hrs	2 hrs	6 hrs	1 hrs	2 hrs
Avg. quantity of <i>Ksharjala</i> obtained	36.33 lit	20.36 lit	49.16 lit	42.16 lit	23.33 lit	53.33 lit
Avg. yield of <i>Ksharjala</i> in percentage	75.66 %	63.64 %	76.82 %	87.84 %	72.99 %	83.33%

RO water was used to avoid more alkaline material from hard water. 100 liter capacity SS vessel with height 435 mm and 750 mm diameter was used for mixing of ash and water. White ash is macerated with water till the pH of water remains constant. The pH of water changes from 7.3 to 9.4, 9.2, 9.6 for 6, 4 and 8 times of water due to

dissolution of alkaline elements like Na, K and Cl from ash. Increase in quantum of water helped dissolving more alkaline salts. The time required to achieve constant pH for Batch A and D was 2 hrs, and 3 hrs for for Batch B, C, E and F. The mixture was immediately filtered in Batch A,C, D and F, and after 9 hrs in batch B and E as per the

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classical reference.⁸The time required for settlement of sediment was 2 hrs, 12 hrs and 3 hrs for 6, 4 and 8 times the water. Repetition of filtration for 21 and 7 times was required when no time was given for sedimentation in batch A, C, D and F. Single time filtration with less duration time (1hr) is sufficient when more time (9hrs) was given for sedimentation of non dissolved material in water. Less yield of the filtrate (*Ksharjala*) was obtained when only 4 time's water is used, as sedimented material adsorbs more percentage of water. More yield of the filtrate (*Ksharjala*) was obtained in batch D, E, F in which ash prepared by

without seeds. Some elements from ash prepared by using seeds may adsorb more quantum of water. *Ksharjala* is salty in taste and slightly yellowish in color. More sedimentation time helps to reduce the frequency and time of filtration. Batch A, C, D and F require 5:30 hrs to form *Yavakshar* through evaporation of the filtrate. While 6 and 3:30 hrs were required to form *Yavakshar* through evaporation of the filtrate in Batch F and B-E respectively. The details of *Yavakshar* preparation are mentioned in Table 2.

Table 2. Observation made during preparation of all samples of *Yavakshar*.

Time	Temperature Recorded and Observations					
	Batch A	Batch B	Batch C	Batch D	Batch E	Batch F
Initial(room temperature)	30 °C	30 °C	30 °C	30 °C	30 °C	30 °C
0-30 min	60 °C	60 °C	60 °C	58-60 °C	60 °C	60 °C
30- 60 min	74-80 °C	75-80 °C	78-80 °C	76-78 °C	76-80 °C	78-80 °C
60-90 min	90-92 °C	90-94 °C	90-92 °C	90-92 °C	90-92 °C	90-92 °C
90-120 min	100 °C Boiling started	100 °C Boiling started	100 °C Boiling started	100 °C Boiling started	100 °C Boiling started	100 °C Boiling started
120-150 min	100 °C	100 °C Vigorous boiling, Adherence of whitish substance to walls of vessel started	100 °C	100 °C	100 °C Vigorous boiling, Adherence of whitish substance to walls of vessel started	100 °C
150-180 min	100 °C Vigorous boiling	100 °C	100 °C Vigorous boiling	100 °C Vigorous boiling	100 °C	100 °C Vigorous boiling
180-210 min	100 °C	No water molecule remain <i>Yavakshar</i> formed	100 °C	100 °C	No water molecule remain <i>Yavakshar</i> formed	100 °C
210-240 min	100 °C Adherence of whitish substance to walls of vessel started	-----	100 °C Adherence of whitish substance to walls of vessel started	100 °C Adherence of whitish substance to walls of vessel started	-----	100 °C

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240-270 min	100 °C	-----	100 °C	100 °C	-----	100 °C Adherence of whitish substance to walls of vessel started
270-300 min	100 °C	-----	100 °C	100 °C	-----	100 °C
300-330 min	No water molecule remain <i>Yavakshar</i> formed	-----	No water molecule remain <i>Yavakshar</i> formed	No water molecule remain <i>Yavakshar</i> formed	-----	100 °C
330-360 min	-----	-----	-----	-----	-----	No water molecule remain <i>Yavakshar</i> formed
Avg. yield of <i>Yavakshar</i>	8.35 %	7.16%	8.29 %	8.91 %	8.20 %	8.87 %

Yava whole plant seed gives more yield of *Yavakshar* than without seed as seeds contain more organic material. Batch B and E prepared by using 4 times water, yield less amount of *Yavakshar* than other batches. Low yield may be due to more soaking of water percentage by sediments due to long duration settlement time. The obtained *Yavakshar* was white in color, salty in taste with peculiar cooling sensation produced on the tongue. XRD pattern of all samples have shown the presence of NaCl crystals in the form of Halite and KCl crystals in the form of Sylvine¹³, which were formed as a result of the evaporation process. Presence of Cl, Na and K in large quantity in all samples indicates that process of maceration and sedimentation helps in dissolution of alkaline material from ash into the water.

Conclusion

Kshar formulation is a method by which alkaline elements of the plant were extracted. A *Kshar* formulation, mainly involves different processes like open charring, maceration, sedimentation and evaporation. Increase in sedimentation time decreases the frequency of filtration. Increase in quantum of water helps dissolving more amount of alkaline

and other material as is seen in batches where only 4 times of water is used. This may be due to adsorption of more quantity of water by other sediment material. Whole *Yava* plant without seeds yields more *Yavakshar* as seeds of *Yava* contain 2 to 3 % of minerals. The average yield of *Yavakshara* from the whole plant ash was 7.93 %, which is 1.07 % of the dried whole plant. While the average yield of *Yavakshara* from the ash of whole plant without seeds was 8.66 %, which is 1.35 % of the dried whole plant without seeds. Data obtained from this study are helpful for further work and to check batch to batch uniformity in case of *Yavakshar* formation.

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Photo No. 1 Cultivation and Harvesting Of Yava (Hordeum Vulgare)



Crop after 1 month



Crop after 2 month



Full matured crop after 3 months



Dried Crop

Photo No.2 Different stages During Ignition of Dried Yava crop

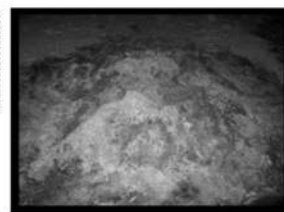


Photo No.3 Mixing of Ash and Filtration Process of YavKshar

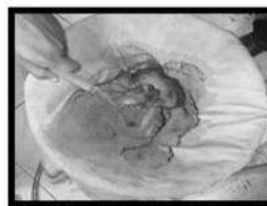
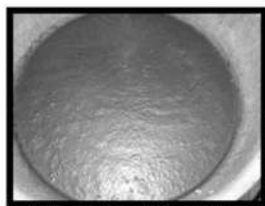


Photo no.4 Process of Evaporation of Filtrate during Yavkshar preparation

