

PHARMACEUTICO-ANALYTICAL STUDIES OF KSHARA OF SINGLE PLANT SOURCE - A REVIEW

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ABSTRACT

Introduction: *Kshara Kalpana* is an alkaline herbo- mineral formulation widely used in Ayurvedic Pharmaceutico- therapeutics. Several plants as Sources of *Kshara varga* are mentioned in Ayurvedic classics. Nature of *Kshara* of plant origin depends on Raw material, process of preparation etc, which may lead to variation in its characteristics. Review of evidence based researches on pharmaceutico analytical nature of different *Kshara* is lacking, hence this work was conducted. **Aim and Objectives-** To review and summarize various online published researches on pharmaceutical and analytical profiles of commonly used *Kshara in* Ayurvedic Pharmaceutico- therapeutics. **Materials and methods-** Online databases, search engines of research journals like Pub med, Google, Google scholar etc. were searched for word “*Kshara*”, prefixed with sentences “studies on standardization of”, “standard manufacturing procedure of”, “Pharmaceutical studies, researches on”, “Analytical studies, researches on”, “Pharmaceutico analytical studies on”. Downloaded research articles were categorized in to Pharmaceutical, Analytical and Pharmaceutico-analytical studies. **Results and conclusion-** Presence of different organic compounds suggests the herbal origin of these alkaline preparations with highest Ph found in *Chitraka kshara* and higher yield in triple washing.

Keywords: *Kshara, Apamarga, Palasha, Yava, Chinchha, Vasa*, Pharmaceutical, Analytical

INTRODUCTION

The term *Kshara* represents a herbo-mineral Ayurvedic formulation that has corrosive property pungent, saline and acrid in nature. Thus it is said to have *Ksharana* property¹. The term *Ksharana* refers to the property of removing defective tissues or metabolic wastes from the body. In another context, *Kshara* is also considered a good *Anushastra*² due to its *Chedana* and *Bhedana* properties. *Kshara* are considered superior than various other sharp instruments of surgical and para surgical procedures in *Shalyatantra*. It has also gained great importance in *Kayachikitsa* in the medical management of *Shwasa, Udara, Kushtha, Ashmari* etc. Different authors have cat-

egorized medicinal plants into groups like *Ksharadwaya, Ksharatraya, Kshara Panchaka, ksharaashtaka* etc. based on their *Kshariyaguna*(alkaline property).The best quality products produced from the authentic raw drugs can be produced by following a standard pharmaceutical guideline and setting various analytical standards. Some basic analytical parameters like organoleptic characters and Physico-chemical analysis along with the use of sophisticated instrumental analysis should be carried out and published for all the *Kshara* which are frequently used in therapeutics. This is necessary to introduce regional system of medicines into global scenario of standard health

care systems. Most of the published articles on *Kshara* are lacking this aspect.

Materials and Methods:

Search method- In present review, pharmaceutical and analytical aspects of *Kshara* were compiled from relevant published research papers in various databases of research journals like J gate, Springer, Scopus, Pub med, Yahoo, Cochrane library, Wikipedia, Worldwidescience.org, NISCARE online periodicals, Ovid, Web of science-Hindwi Publications, Biomed central, Health system global-HSG, Taylor and francis, Google, Google india, Google scholar, Wolter coulter, Omics international were searched for word “*Kshara*”, prefixed with sentences “studies on standardization of”, “standard manufacturing procedure of”, “Pharmaceutical studies, researches on”, “Analytical studies, researches on”, “Pharmaceutico analytical studies on”.

Inclusion criteria- Articles either exclusively, predominantly on Pharmaceutico-analytical study of *Kshara* derived from single herbal *Kshara Dravya*, or containing substantial related data of *Kshara* from studies of other research areas were included. Articles displayed in minimum first 2 pages of website of respective search engines (else till display of webpage page without relevant matter) were included.

Exclusion criteria- Articles predominantly on literature review, Safety study, pharmacological studies and clinical efficacy, without substantial pharmaceutico-analytical data of plant based *Kshara* of single drug were excluded from the study. Articles on compound formulations of *Kshara* where *Kshara* (s) is an ingredient or classical *Kshara Kalpa*, formulations of processed *Kshara* were excluded.

Repeated same research work in different publications was considered as one. Available research papers were categorized, information was gathered under certain common headings.

Observation:

It is observed that, original researches mainly on Pharmaceutical, analytical studies are limited and they are also found to be conducted on limited number of *Kshara*. Pharmaceutico-analytical information of *Kshara* in other published researches mainly on other than pharmaceutico-analytical study is meager and is also not expressed in scientific manner.

❖ Pharmaceutical review:-

On the basis of published researches, the procedure of *Kshara* preparation in modern era can be summarised as follows - *Panchanga* of matured plant is collected, cleaned and dried in sunlight for about 8 days(till complete drying). It is taken in big open iron pan, ignited and allowed to burn completely and after self-cooling white ash is collected. The ash is taken in a specially designed steel vessel and standard amount of water is added to it (as recommended, table 1). The contents are rubbed thoroughly with the hand, stirred well and left soaked undisturbed for prescribed time limit (12 hours). After this, clear supernatant liquid layer is collected through the designed outlet of the vessel. This drained liquid is again filtered through folded cotton cloth to get *Ksharajala*. The soaking and filtration process is repeated twice with residual ash to get two more batches of *Ksharajala* which usually increases the yield of the product. All the batches of *Ksharajala* are individually subjected to heat till water is evaporated and product *Kshara* is left behind.

Table 1: Pharmaceutical observations and results of researches on *Kshara*

<i>Kshara</i>	Reference of preparation	%Wt. loss on drying	% Avg. Ash obtained	Avg. time for <i>Ksharajala</i>	%Avg. of <i>Kshara</i> obtained	% Total <i>Kshara</i> obtained
<i>Apamarga</i> ³	<i>Rasatarangini</i> 14/59	59.81	4.78	4 hrs	1 st wash-21.23% 2 nd wash-9.38% 3 rd wash-4.76%	35.37
<i>Palasha</i> ⁴	<i>Sushruta Samhita</i> 11/11	48.64	11.29	3.94 hrs	1 st wash-19.26% 2 nd wash-9.46% 3 rd wash-6.5%	35.22
<i>Yava</i> ⁵	<i>Rasatarangini</i> 13/3-5 <i>Rasatarangini</i> 14/59-61	42.88	13.43 % of dried wt.	General method – 3 hrs Specific method- 2 hrs	General -9.67% of ash Specific- 11.72% of ash	9.67% by general method 11.72% by specific method
<i>Chincha</i> ⁶	<i>Rasatarangini</i> 14/59-61	Dry plant was taken	3.68	3 hrs	Batch 1- 0.66% Batch 2- 0.63%	From <i>Kastha</i> - 0.63%

						Batch 3- 0.62%	From Ash- 17.36%
<i>Vasa</i> ⁷	Sushruta hita11/11	Sam-	60.71	6.57	3.94 hr	1 st wash- 16.95% 2 nd wash- 8.68% 3 rd wash- 2.56%	28.19%
<i>Mulaka</i> ⁸	Sushruta hita11/11	Sam-	94.68	20.23	15.16 hrs	1 st wash- 0.456% 2 nd wash- 0.253%	0.713%

Analytical review:-**Table 2:** Organoleptic characters of some *Ksharas*

Sr. No.	<i>Kshara</i>	Colour (<i>Rupa</i>)	Taste (<i>Rasa</i>)	Touch (<i>Sparsha</i>)	Odor (<i>Gandha</i>)	Consistency
1	<i>Apamarga</i>	White	Salty	Slimy	Characteristic	Fine powder
2	<i>Palasha</i>	Brown	Pungent astringent	Smooth	Characteristic	-----
3	<i>Yava</i>	Light cream	Acrid sweet cool	Coarse	Unpleasant	Coarse powder
4	<i>Chincha</i>	-----	-----	-----	-----	-----
5	<i>Vasa</i>	Green	Bitter	Smooth	-----	Fine powder
6	<i>Mulaka</i>	Whitish brown	Salty	Slimy	Characteristic	-----
7	<i>Kadali (Asam)</i> ⁹	Chocolate brown	Specific taste with salty-pungent predominance	Dry powder having feathery sensation and finger feels smoothness	Mild specific odour	-----
8	<i>Kadali (BHU, Varanasi)</i> ¹⁰	Dirty white	Specific taste with predominance of pungent -bitterness	Dry powder having feathery sensation and finger feels smoothness	Mild specific odour	-----
9	<i>Tilanala</i> ¹¹	Creamy white	Specific taste with salty-bitterness predominance	Dry powder having gritty sensation and /3finger feels smoothness	Mild specific odour	-----
10	<i>Narikela</i> ¹²	Pure white	Specific taste with predominance of salty bitterness	Dry powder having gritty sensation and finger feels smoothness	Mild specific odour	-----
11	<i>Matikalaya (Masha)</i> ¹³	Mica brown	Specific taste with light salty pungent	Dry powder having gritty sensation and finger feels smoothness	Mild specific odour	-----

Table 3: Physico-chemical parameters of some *Ksharas*

Sr. No.	<i>Kshara</i>	Loss on drying(%w/w)	Ash value (%w/w)	Acid insoluble ash (%w/w)	Ph	Water soluble extract %
1	<i>Apamarga</i>	1.4	95.01	0.91	10.81	97.11
2	<i>Palasha</i>	3.012	94.1	0.27	9.6	Alkalinity= 17 ml
3	<i>Yava</i>	4.5	96.75	3	10.5	91
4	<i>Chincha</i>	3.23	75.13	0.39	10.2	----
5	<i>Vasa</i>	2.616	94.21	0.2	10.05	Alkalinity= 16.75ml

6	<i>Mulaka</i> ¹⁴	94.68	18.11	0.91	6.8	73.95
7	<i>Chitraka</i> ¹⁵	13.03	----	----	11.44	----

Table 4: Elemental analysis of *Kshara*

Elements (%) <i>Kshara</i> ↓ →	Na	K	Cl	Ca	Mg	Fe	Si	O	Other dominant pre-elements	Heavy metals
<i>Apamarga</i> ^{16@}	>1737.26	>1334.11	----	7.569	1.833	0.036	116.349	----	Hg- ND, Cd- ND, Pb- ND	ND
<i>Palasha</i> ^{17,*}	0.233	19.9	12.45	0.099	4.6	0.056	----	----	Si, Br, Rb	----
<i>Yava</i>	190	24000	78597	1100	173	268	----	----	Sulphate, Nitrate	----
<i>Chincha</i> [^]	126.5k	10k	149.9k	33.3k	117.3k	----	23.9k	498.1k	----	----
<i>Vasa</i> ¹⁸	+	+	+	----	----	----	----	----	----	Hg- ND, Cd- ND, As- 0.0985, Pb-0.092
<i>Chitraka</i>	10.76	6.84	----	----	----	----	----	----	Total alkalies (Carbonates-3.76%)	----
<i>Kadali</i> *(Asam)	0.87	17.7	59.1	0.057	0	0.184	1.74	----	Cd, Al, Rb, Br	----
<i>Kadali</i> (BHU, Varanasi)	0.71	12.43	75.36	0.085	0.546	0.576	2.52	----	Cd	----
<i>Tilanala</i> [*]	0.26	36.92	30.92	0	0	0.054	1.35	----	Rb, Ag	----
<i>Narikela</i> [*]	4.61	9.07	77.09	0.042	0	0.0486	1.54	----	ND	----
<i>Matikalaya</i> [*] (<i>Masha</i>)	0	27.77	----	0.09	3.05	0.0317	0.365	----	ND	----

Method of Analysis-ICP[@], XRF^{*}, Titration, Flame photometry, Spectrophotometry, AAS, EDAX[^]
k = 1000 ND = Not detectable.

Sophisticated instrumental techniques:**A) APAMARGA KSHARA-****Table 5:** AES-ICP analysis of *Apamarga Kshara*

Elements	As	Pb	Hg	Cd	Si	Fe	Na	Ca	Mg
Avg Value (ppm)	0.333	ND*	ND	ND	110.73	0.215	>1915.13	11.72	2.885

*ND= not detected

2. Field Emission Gun Scanning electron microscope (FEG-SEM)**Table 6:** FEG-SEM analysis of *Apamarga Kshara*

ELEMENTS	Weight %	Atomic %
Pb La	-1.861	-620.632
Au La	0.000	0.000
Cu Ka	-0.199	-216.773
Fe Ka	-0.388	-479.676
Ca Ka	-0.063	-109.042
Cd La	-0.417	-256.194
Ag La	0.403	258.319
S Ka	0.288	619.712
P Ka	0.000	0.000
Si Ka	0.413	1016.102

Se La	-0.075	-65.592
Mg Ka	-0.016	-46.223
Total	-1.916	

3. X- Ray diffraction (XRD) or crystallography

Table 7: XRD analysis of *Apamarga Kshara*

Sr. No.	Pos. [°2Th.]	Height [cts]	FWHM [°2Th.]	d-spacing [Å]	Rel.Int. [%]
1	21.6046	68.42	0.1004	4.11340	1.69
2	24.0709	64.64	0.1004	3.69724	1.60
3	26.6208	43.59	0.1338	3.34861	1.08
4	28.6094	4043.93	0.0502	3.12021	100.00
5	29.5220	183.81	0.2342	3.02580	4.55
6	30.0837	262.55	0.1004	2.97058	6.49
7	31.0701	374.05	0.0502	2.87848	9.25
8	32.4042	164.12	0.0502	2.76295	4.06
9	33.0568	148.60	0.1338	2.70989	3.67
10	35.9362	66.85	0.1004	2.49909	1.65
11	37.4189	39.49	0.2007	2.40340	0.98
12	38.1572	80.65	0.1338	2.35858	1.99
13	40.7584	1468.25	0.1338	2.21386	36.31
14	43.8399	163.64	0.0612	2.06342	4.05
15	48.9925	69.51	0.2676	1.85932	1.72
16	50.4259	623.40	0.0816	1.80828	15.42
17	50.5641	298.09	0.0816	1.80815	7.37
18	58.8819	213.65	0.1224	1.56716	5.28
19	66.6129	419.95	0.1020	1.40280	10.38
20	66.8093	219.84	0.0816	1.40262	5.44
21	73.9146	170.80	0.1224	1.28123	4.22
22	94.7151	81.53	0.1632	1.04718	2.02

B) PALASHA KSHARA-

1. On qualitative estimation presence of Sodium, Pottasium, Chloride, Carbonate and Phosphate were found.

2. In ICP-AES test Hg and Cd were not detected and as was found in the amount of 0.02 ppm in 1st sample and 0.053 ppm in 2nd sample and Pb was found in amount of 0.038 and 0.119 ppm respectively. Sulphate ions were not detected by Shobhnath *et al.*

Table 8: FTIR study of *Palasha Kshara*

Sr. no.	Peak region	Samples	No. of peaks	Obtained peaks
1	Hydrogen stretching region 3700 to 2700 cm ⁻¹	Palash-1	4	3517.23,3479.2,2926.80,2856.55
		Palash-2	2	3423.40, 2926.22
2	Triple bond region 2700- 1950 cm ⁻¹	Palash-1	1	2085.97
		Palash-2	1	2085.29
3	The double bond region between 1950 and 1550 cm ⁻¹	Palash-1	2	1632.50, 1558.62
		Palash-2	2	1651.23, 1568.83
4	The fingerprint region between 1500 and 700 cm ⁻¹	Palash-1	8	1464.41,1413.53,1386.97,114.62, 982.37,878.97,780.29,617.83

The FTIR study of *Palash Kshara* indicates the presence of alkyl, carbonyl or ester and halide group.

C) YAVA KSHARA-

1. Chloride was found 78597 ppm by Titration method.
2. Sulphate was found to be 3813.3 ppm by UV method.
3. Nitrate was found to be 871.80 ppm by UV method.

4. Potassium was found to be 24000 ppm by Flame photometry.
5. Calcium was found to be 1100 ppm by AAS method.
6. Iron was found 268 ppm by AAS method.

7. Magnesium was found 173 ppm by AAS method.

D) CHINCHA KSHARA –

Table 9: EDAX analysis of *Chincha Kshara*

ELEMENT	WEIGHT %	ATOMIC %
O K	49.81	63.66
Na K	12.65	11.25
Mg K	11.73	9.87
Si K	2.39	1.74
S K	4.10	2.61
Cl K	14.99	8.65
K K	1.00	0.52
Ca K	3.33	1.70
Totals	100.00	100.00

E) VASA KSHARA –

1. On qualitative estimation presence of Sodium, Potassium, Chloride, Carbonate and Sulphate were found.

2. In ICP-AES test Hg and Cd were not detected and As was found in the amount of 0.158 ppm in 1st sample and 0.039 ppm in 2nd sample and Pb was found in the amount of 0.077 and 0.107 ppm respectively.

Table 10: FTIR study of *Vasa Kshara*

Sr. no.	Peak region	Samples	No. of peaks	Obtained peaks
1	Hydrogen stretching region 3700 to 2700 cm-1	Vasa-1	2	3464.71, 3389.34
		Vasa-2	1	3421.37
2	Triple bond region 2700- 1950 cm-1	Vasa-1	1	2314.80
		Vasa-2	-	-
3	The double bond region between 1950 and 1550 cm-1	Vasa-1	2	157036
		Vasa-2	2	1632.18, 1571.15

Phosphate ions were not detected in *Vasa Kshara* by *Shobhnath et al.* and FTIR report of *Vasa Kshara* showed the presence of alkyl, carboxylic or nitro-aliphatic compound, trisubstituted alkenes, and cis-disubstituted alkenes.

DISCUSSION

Although *Kshara Kalpana* is widely practiced in Ayurveda but here we can see that only a small number of *Kshara* are used in clinical practices and research works. Nearly equal number of study are being carried out in internal and external administration but are mainly focused on clinical efficacy. More than 30 *Kshara* are mentioned in *Brahattrayi* but nearly 2/3 of these are not widely practiced.

■ In Pharmaceutical review it is observed that reference of Sushruta Samhita is most commonly used method of *Kshara* preparation and approximately 43 to 95% of weight loss is seen drying. 3.68 to 20.23% of ash was found in above plants.

- Subsequent triple washing of the ash is preferably used to increase the yield of *Kshara*.
- Maximum 35.37% of *Kshara* is obtained w/w of ash.
- Ph of the above mentioned *Kshara* was found from 9.6 to 10.81 which is suitable for internal administration but for external use Ph should be more alkaline.
- Most of the *Kshara* are white, creamy or brown colored with salty pungent taste.
- Presence of Sodium and Potassium was common in all these herbal *Kshara* preparations.
- Other minerals like Chloride, Sulphate, Calcium, Magnesium, Iron, Nitrate are also seen in different proportions.
- The heavy metals were seen within the permissible limits in almost all these *Kshara* preparations.

Although there are number of (26 in Charaka Samhita, 23 in Sushrut Samhita) herbal sources for derivation of *Kshara* as per different classics, however only few have been studied whose pharmaceutico-analytical details are published online which are namely *Kshara* of *Apamarga*,

Palasha, Yava, Chinch, Chitraka, Snuhi, Vasa, Kadali, Tilanala, Narikela, Matikalaya (Masha), and Sarshapa.

A chapter of *Lavana- Kshara* has been included in AFI part-I, 10th chapter. In this book different formulations of *Kshara* with references, doses, *Anupana*, therapeutic uses etc. are described.¹⁹

- ◆ Drug and cosmetic act, 1940 also states the list of machinery, Equipment and minimum manufacturing premises required for the manufacturer of *Kshara*²⁰.
- ◆ The methods of *Kshara* preparation vary from each other on the basis of ratio of water to the ash, type of vessel used, duration of soaking, number of filtrations through cloth etc. These methods are described in table as follows.

To check potency of *Kshara*, in ancient times its corrosiveness was being tested as explained by *Acharya Sushruta* i.e. testing its corrosiveness on pith of castor plant stem.

CONCLUSION

Kshara can be used as Ayurvedic alkalizer to maintain acid base homeostasis of the body in present time as all the *ksharas* are rich source of potassium salts which is the best alkalizer. Percentage yield of *Kshara* is more in the first wash of ash then decreases in other subsequent two wash. Highest Ph was seen in *Chitraka Kshara* among these plants indicating its higher corrosive nature suitable for external use. The presence of different organic compounds suggests the herbal origin of these alkaline preparations. There is very small number of *Kshara* used for publications in clinical practices and research works among the vast variety mentioned in Ayurvedic classics.

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Source of Support: Nil

Conflict Of Interest: None Declared

How to cite this URL: Om Pandey et al: Pharmaceutico-Analytical Studies Of Kshara Of Single Plant Source - A Review. *International Ayurvedic Medical Journal* {online} 2018 {cited January, 2019} Available from: http://www.iamj.in/posts/images/upload/65_71.pdf