



Research Article

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COMPARATIVE PHARMACEUTICO-ANALYTICAL STUDY OF SHUSHKA KASAHARA ARKA AND ITS MODIFICATION INTO NEBULIZING LIQUID

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ABSTRACT

Arka Prakasha, a scientific treatise, written by Lankapathi Ravan explains in detail about the Arka preparations (distillation process). One such formulation is called as 'Shushka Kasahara Arka' which contains ingredients such as Kantakari, Draksha, Vasa etc. indicated in Shushka Kasa (dry cough). Navasadara (Ammonium chloride) is a Sadharana Rasa explained in Rasa Shastra texts which is known for its expectorant action in the upper respiratory tract. Nebulization is an important dosage form where medicines are in liquid form and can be converted to vapours. The inhalation of this helps in direct action of the medicines over the respiratory tract causing broncho-dilation and expectoration of increased phlegm. Since most of the ingredients present in the formulation have Kasahara (cough suppressant) and Shwasahara (broncho-dilator) property, Arka (distillate) produced by simple distillation method is analysed for its physico-chemical parameters. The pH of Shushka Kasahara Arka and its modified nebulizing liquid is 4.64 and 5.52 respectively. The HPTLC of both the samples showed an important bio-marker solasodine which is known for its anti-inflammatory, anti-oxidant activity. Percentage composition of solasodine in SKHA-1 was 8.85% and that of SKHA-2 was 16.8%. The heavy metal testing for mercury, cadmium, arsenic and lead was found to be within the standard limits as per API.

Keywords: Arka Prakasha, Shushka Kasahara Arka, Navasadara, nebulizing liquid, simple distillation, solasodine.

INTRODUCTION

Arka Prakasha is a scientific treatise written by Lankapathi Ravan which explains in detail about the Arka preparations (distillation process). One such Arka mentioned in Arka Prakasha is called as 'Shushka Kasahara Arka'¹ which contains ingredients such as Kantakari, Draksha, Vasa etc. indicated in Shushka Kasa (dry cough). Navasadara (Ammonium chloride) is a Sadharana Rasa explained in Rasa Shastra texts like Rasa Tarangini which is known for its Kapha Vishleshana or expectorant action in the upper respiratory tract.² Kasa (cough) is one of the diseases explained in Ayurveda with different treatment modalities. Among these, the administration of drug through nasal route in the form of fumes is known as Dhumapana (medicated inhalation).³ In present day, the management of cough is done by Nebulization. Many researches have been conducted to check the efficacy of various Arka (distillate) as nebulizing fluid in respiratory disorders.⁴ Nebulization is an important dosage form where medicines are in liquid form and will be converted to vapours using nebulizers.⁵ The inhalation of this helps in direct action of the drug over the respiratory tract causing broncho-dilation and expectoration of phlegm. Hence an attempt was made to do pharmaceutical study of Shushka Kasahara Arka and its modified nebulizing liquid and comparison of physico-chemical analysis of both the samples were done.

MATERIALS AND METHODS

Materials required: Classical texts, articles/journals, Khalwa Yantra (mortar and pestle), measuring jar, weighing machine,

plastic bowls, simple distillation apparatus, unused cloth, steel spoon.

Pharmaceutical Study

1. Purification of Navasadara (Ammonium chloride)
2. Preparation of Shushka Kasahara Arka as per classical reference
3. Preparation of Shushka Kasahara Arka Nebulizing liquid

Purification of Navasadara

Reference: Rasa Tarangini, 14th chapter, 3-4

Principle: Nirjalikarana (dehydration)

Equipment: Steel vessel, gas stove, measuring jar, weighing machine, mortar and pestle, spatula, Kora cloth, steel plates, muffle furnace.

Procedure: 500g Navasadara was made into coarse powder by pounding it in Khalwa Yantra (mortar and pestle). Later it is taken in a steel vessel and 3 parts of water that is 1500ml is added to the steel vessel and stirred with spatula to facilitate complete dissolution of Navasadara. The mixture is filtered through clean unused cloth to remove any physical impurities and later it is taken in a steel vessel. The steel vessel is kept over gas stove for heating on moderate fire so that all the water content is evaporated. Heating is stopped once we get the white precipitate. The precipitate is once again dried under sunlight and using muffle furnace to get dried white powder of Navasadara. Obtained product is stored in an airtight plastic container as Shodhita Navasadara (purified ammonium chloride).⁶

Preparation of Shushka Kasahara Arka using simple distillation method

Reference: Arka Prakasha⁷

Principle: Arka Kalpana (simple distillation)

Equipment: Simple distillation apparatus, plastic bowl, steel vessel, spatula, measuring jar, weighing machine, ice cubes, aquarium water motor, bucket, holder stand, mortar and pestle.

Procedure: It is divided into 3 steps:

Purva Karma: All the dry drugs such as Kankari, Karchura, Nagara, Pippali and Ahiphena are taken in the specified quantity in a mortar and pestle and is pounded to make coarse powder. Later it is poured in a clean steel vessel and is added with 112.5ml (2 times) of water and kept for soaking for 24 hours.

Pradhana Karma: Soaked coarse powder are taken in a round-bottom glass flask and wet drugs such as Vasa and Draksha are made into Kalka (paste) and added to round-bottom glass flask. Specified quantity of water is also added to the round-bottom flask and it is placed over the heating mantle. It is fixed to condenser via bends and receiving flask is kept ready. Tubes connecting condenser inlet and outlet were kept inside a bucket containing ice-cold water for proper condensation. Heating was started and the temperature was maintained at 80°C and the distillation process continued till 60% of Arka was obtained. Total time taken was noted and obtained Arka was allowed for self-cooling.

Pashchat Karma: Obtained Arka (distillate) was measured using measuring jar and stored in an air-tight container labelled as SKHA-1.

Preparation of Shushka Kasahara Arka Nebulizing liquid

Equipment: Plastic bowl, steel vessel, spatula, measuring jar, weighing machine.

Procedure: Shushka Kasahara Arka is taken in a clean steel vessel, and it is added with specified quantity of purified Navasagara and stirred well until it completely dissolves in the Arka. This mixture is stored in an air-tight container labelled as SKHA - 2.

Analytical study: Two samples SKHA-1 and SKHA-2 were subjected to physico-chemical analysis with HPTLC at SDM centre for research in Ayurveda and Allied Sciences, Udipi and test for heavy metals at Nisargam Amrith labs, Shivamogga, Karnataka, India.⁸

LINOMAT 5 Applicator – serial no. 180102

CAMAG TLC scanner 4 – serial no. 171129

WinCATS software 1.4.6

CAMAG Visualization Chamber

Sample coded as: 25050801-02

10ml of Samples of SKHA1 and SKHA2 were extracted with 20.0ml of *n-Hexane*. 6 and 12µl of the above extract was applied on a pre-coated silica gel F₂₅₄ on aluminum plates to a band width of 7 mm using Linomat 5 TLC applicator. The plate was developed in Toluene: Ethyl acetate: Di ethyl amine (6:0.5:0.5). The developed plates were visualized short UV, long UV and then derivatised with vanillin sulphuric acid observed under white light and scanned under UV 254 and 366 nm. R_f, colour of the spots and densitometric scan were recorded.

Table 1: Ingredients for purification of Navasagara (ammonium chloride).

Ingredients	Parts used	Quantity
Navasagara	As such	500g
Water	As such	1500ml

Table 2: Ingredients of Shushka Kasahara Arka

Ingredient	Botanical name	Parts used	Quantity
Kankari	<i>Solanum xanthocarpum</i> Schard. Wendl	Whole plant	22.5g (2 parts)
Draksha	<i>Vitis vinifera</i> Linn.	fruit	11.25g (1 part)
Vasa	<i>Adhatoda vasica</i> Nees.	leaves	11.25g (1 part)
Karchura	<i>Curcuma zedoaria</i> Roscoe.	rhizome	11.25g (1 part)
Nagara	<i>Zingiber officinale</i> Roscoe.	rhizome	11.25g (1 part)
Pippali	<i>Piper longum</i> Linn.	fruit	11.25g (1 part)
Ahiphena	<i>Papaver somniferum</i> Linn.	seed	11.25g (1 part)
Water		As such	900ml (10 times)

Table 3: Ingredients of Shushka Kasahara Arka nebulizing liquid

Ingredients	Parts used	Quantity
Navasagara	As such	250mg
Shushka Kasahara Arka	As such	2.5ml

OBSERVATION AND RESULTS

Table 4: Results of purification of Navasagara (ammonium chloride)

TDS of water used for purification	59ppm
TDS of water with dissolved Navasagara (before filtration)	9047ppm
TDS of water with dissolved Navasagara (After filtration)	5655ppm
Quantity of purified Navasagara	687g
Gain percentage	37.4%
Time taken for the procedure	1 hour 10 minutes

Table 5: Results of preparation of Shushka Kasahara Arka (SKHA-1)

TDS of water used for Simple distillation	24ppm
Quantity of ice cubes used for condensation	2.5kg
Quantity of Shushka Kasahara Arka	525ml
Loss percentage	41.6%
Time taken for the procedure	5 hours 05 minutes

Table 6: Results of Shushka Kasahara Arka nebulizing liquid (SKHA-2)

TDS of nebulizing liquid after adding Navasagara	105 ppm
Quantity of Shushka Kasahara Arka taken	1000ml
Quantity of Shushka Kasahara Arka Nebulizing liquid obtained	1000ml
Loss percentage	No loss
Time taken for the procedure	4 minutes 30 seconds

Table 7: Results of physico-chemical analysis

Parameter	Results n = 3% w/w	
	SKHA - 1	SKHA - 2
Color	Colourless	Colourless
Odour	Characteristic	Aromatic pleasant
Taste	Strong and spicy	Strong and spicy
Clarity test	Clear solution (Devoid of particles) and visible signs of growth	Clear solution (Devoid of particles) and visible signs of growth
Volatile matter (%)	0.12	0.10
Specific gravity	0.9710	0.9630
Refractive index	1.33207	1.34107
pH	4.64	5.52
Viscosity	1.01	0.99
Total acidity	0.02	0.59

Table 8: HPTLC of SKHA-1 and SKHA-2

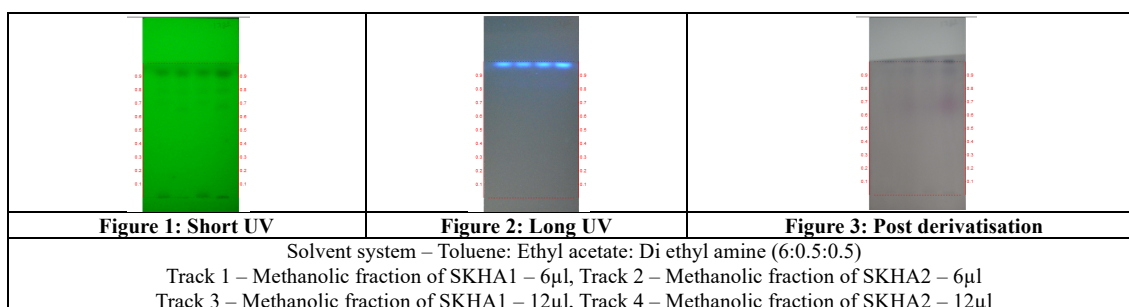


Table 9: R_f values of Methanolic fraction of SKHA - 1 and SKHA - 2

Short UV		Long UV		Post derivatisation	
SKHA - 1	SKHA - 2	SKHA - 1	SKHA - 2	SKHA - 1	SKHA - 2
-	0.67 (Green)	-	-	-	0.68 (Pink)
0.71 (Green)	-	-	-	-	-
0.79 (Green)	0.80 (Green)	-	-	-	-
0.93 (Green)	0.93 (Green)	-	-	0.93 (Purple)	0.93 (Purple)

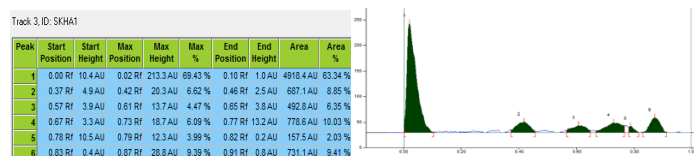


Figure 4(a & b): Densitometric scan of SKHA-1 at 254nm (short UV)

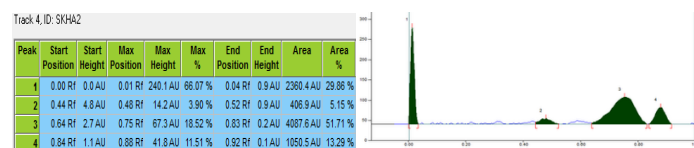


Figure 5(a & b): Densitometric scan of SKHA-2 at 254nm (short UV)

Table 10: Test for heavy metals of SKHA-1 and SKHA-2

Parameter	Limits	Results of SKHA-1	Results of SKHA-2
Lead	10 mg/L	0.012 mg/L	0.003 mg/L
Arsenic	3 mg/L	Absent	Absent
Mercury	1 mg/L	0.004 mg/L	Absent
Cadmium	0.3 mg/L	Absent	Absent



Figure 6: Navasadara (ammonium chloride)



Figure 7: Powdering of Navasadara



Figure 8: Pouring Navasadara to vessel



Figure 9: Pouring water to vessel



Figure 10: Filtering of the mixture



Figure 11: Heating of the mixture



Figure 12: Purified Navasadara



Figure 13: Dry drugs



Figure 14: Dry drugs kept for soaking



Figure 15: Wet drugs – Vasa and Draksha



Figure 16: Pouring water to the mixture



Figure 17: Pouring mixture to the flask



Figure 18: Preparation of Arka using simple distillation



Figure 19: Final product of Shushka Kasahara Arka



Figure 20: Ingredients of SKHA nebulizing liquid

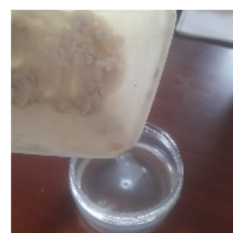


Figure 21: Pouring purified Navasadara



Figure 22: Final product of SKHA nebulizing liquid

DISCUSSION

Shushka Kasahara Arka contains ingredients that are dominantly Ushna Virya (hot potency) and Kaphavatahara (reduces Vata and kapha in the body) in properties and hence mainly indicated in cough, dyspnoea etc. Arka Kalpana is an important liquid dosage form in Ayurveda whose principle is mainly based on extraction of volatile phyto-principles that are mainly hydrophilic in nature. The phytoconstituents found in Arka (distillate) are usually dissolved solids in water media that is more potent and quicker in action compared to other liquid dosage forms such as Kwatha (decoction), Hima (cold infusion), Phanta (hot infusion) etc.⁹ where phytochemicals are colloidal in nature. The particle size of phyto-constituents present in Arka (distillate) is usually at the range of 2 μ m¹⁰ and the particle size range for nebulization is 1-5 μ m.¹¹ Hence Arka is a better dosage form for nebulization using nasal route mainly indicated in respiratory diseases. Distillation of mixture of raw drugs were done in low flame with temperature not more than 80°C to prevent charring of raw drugs and to preserve the phytochemicals that are more thermolabile. Even as per Arka Prakasha, time taken for Arka preparation can go up to 9 hours for best quality.¹² Both the sample were found to be colourless with an aromatic pleasant odour with volatile matter being very less. As water was chosen as media for extraction of Arka, many non-polar oils were not extracted properly through this method. Both the samples were liquid similar to water and hence their specific gravity is close to the water and there's a slight difference between the refractive index of samples with that of the distilled water. This shows that the samples contain other dissolved phyto-chemicals which can be further understood by HPTLC.¹³ The HPTLC of both the samples show an important bio-marker Solasodine, a steroidal alkaloid with R_f values of 0.38, 0.42, 0.56 and 0.75 which is also one of the important phytochemical of Kantakari.¹⁴ Percentage composition of solasodine in SKHA-1 was 8.85% and that of SKHA-2 was 16.8%. Studies shows that solasodine has anti-cancerous, anti-inflammatory activity and immuno-modulatory effects.¹⁵ The heavy metal testing shows that both the samples were devoid of heavy metals like mercury, lead, arsenic and cadmium. The total acidity is more in Arka with Navasagara (ammonium chloride) compared to the plain Shushka Kasahara Arka which is mainly due to the presence of free chlorine ions in the former.

CONCLUSION

The study of pharmaceutico-analytical comparison between Shushka Kasahara Arka and its nebulizing liquid made by addition of Navasagara has provided valuable insights in to the variations in the physico-chemical parameters. Main differences are seen in pH, total acidity and refractive index. All other parameters like HPTLC, heavy metal assay shows that Shushka Kasahara Arka nebulizing liquid can be used as medicine and it may have potential benefits in curing diseases.

Limitations and Further Scope: Further studies on animals need to be conducted to assess safety and its pharmacological actions in inhalational route of administration. Further clinical study can also be undertaken to know the efficacy and possible adverse drug reactions of the drug in inhalational route of administration. Particle size estimation and stability study of the drug was not

done and it should be taken as a future study to enhance our understanding of the drug.

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