Research Article

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COMPARATIVE STUDY ON DASAMULA ARKA PREPARED BY TWO DIFFERENT METHODS

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ABSTRACT

Introduction: Preparing arka (distillate) involves a series of steps to obtain a highly efficacious, easily assimilable, palatable herbal formulation that produces the desired therapeutic effect at minimal dosage, with minimal or no adverse effects. Traditionally, arka is prepared using an Arka Yantra. Moreover, the traditional method makes it challenging to maintain uniform, controlled heating and may also contribute to environmental pollution. Given these limitations, modern distillation apparatus is increasingly used to prepare arka because it offers better temperature control and a more convenient, standardised distillation method. Aim and Objective: To compare arka prepared using a modern distillation apparatus with arka prepared traditionally using Arka Yantra and to assess the utility of the distillation apparatus. Materials and methods: Raw drugs of Dasamula arka were collected, and authentication was done. We conducted a comparative study of Dasamula arka prepared by the traditional method and using a distillation apparatus, with special reference to physicochemical properties. We evaluated the prepared Dasamula arka using both modern and Ayurvedic parameters. Outcome: Dasamula arka prepared by both methods showed similar organoleptic and physicochemical properties. Conclusion: Overall, the findings suggest that Dasamula arka exhibits similar qualities, but Arka preparation in a conventional distillation apparatus is more convenient than the traditional method using Arka Yantra.

Keywords: Arka Yantra, Distillation apparatus, Dasamula arka

INTRODUCTION

Panchavidha kashaya Kalpana (five basic forms of pharmaceutical preparations) are the major dosage forms mentioned in Ayurveda.[1] Arka is one of them, which is considered as the most powerful, as per Raavana's Arka Prakasha.[2] Arka Prakasha contains descriptions of many single-drug arka preparations and oushadha yogas (medicinal formulations) of arka, which are useful in a variety of diseases.

Arka Kalpana is a pharmaceutical drug delivery form prepared by collecting the volatile oil and active principles of the drugs through simple distillation using an Arka Yantra or any modern distillation apparatus. The drugs are immersed in water overnight to improve water absorption and soften the drug, facilitating proper extraction. The distilled essence of these drugs collected in liquid form is termed as "Arka."[3] The word 'Arka' is derived from 'Ru – gatau.' [4] Every word contains meanings. Gati (motion) denotes three different meanings, i.e., Gyan, Gaman, and Prapti. In the Arka process, all three meanings are to be accepted, as the knowledge of the contents of the drug is the first thing (i.e., Gyan) then the motion is given to the contents through water (i.e., Gaman), and lastly the required amount of active content is obtained (i.e., Prapti). It is a treasured formulation because it reduces dosage, improves patient compliance, and increases potency.

Traditionally, when prepared with Arka Yantra, it has several drawbacks, including high fuel consumption, environmental pollution, uneven heating, high labour, and a time-consuming process. Modern distillation apparatuses are available today for preparing arka and effectively overcome the limitations of traditional Arka Yantra methods. Dasamula arka is a formulation mentioned in Ayurveda Sara Sangraha. [5] It was selected for the present work because the herbal drugs fall under the category of very dry and hard herbs, which require a longer duration, making it well suited to this study.

Aim and objectives

To compare arka prepared using a modern distillation apparatus with traditionally prepared arka using Arka Yantra, and to assess the utility of the distillation apparatus.

MATERIALS AND METHODS

Selection of the raw material

To prepare Dasamula arka, we collected the ingredients, Bilwa, Agnimantha, Shyonaka, Patala, Gambhari, Brihati, Kantakari, Shaalaparni, Prisniparni, and Gokshura, from different vendors across the state. We gathered three samples of each raw drug and labelled them sample 1, 2, and 3, respectively.

Sample 1 was obtained from a drug store situated at Trivandrum.
Sample 2 was obtained from a drug store situated at Ernakulam
Sample 3 was obtained from a drug store situated at Tripunithura.

Processing of raw drugs

Raw drugs like Bilwa, Agnimantha, Shyonaka, Patala, Gambhari, Brihati, Kantakari, Shaalaparni, Prisniparni and Gokshura were collected and washed thoroughly with water to remove physical impurities and thoroughly dried in the shade. A portion of the drug sample was set aside for macroscopic, pharmacognostic and powder microscopic evaluations. After the evaluation, raw drugs of Dasamula belonging to sample 3 were used for further studies.

Preparation of Dasamula arka

According to the method for preparing Arka described in Rasatantrasara va Sidhaprayoga sangraha, one part of the drug was soaked in water 10 times its weight. [6] Approximately 40 g each of the powdered drugs—Bilwa, Agnimantha, Shyonaka, Patala, Gambhari, Brihati, Kantakari, Shaalaparni, Prishniparni and Gokshura was soaked in 2 litres of sterilised distilled water for 24 hours. Before distillation, the remaining 2 litres of sterilised distilled water were added to the soaked material. The mixture was then distilled by two methods: Batch A using the Arka yantra, collecting the distillate in the Arka patra; and Batch B using a distillation apparatus, collecting the distillate in a suitable receiver. In both batches, the initial drops were discarded, and the subsequent distillate was collected. The distillates obtained from both batches were subsequently subjected to analytical evaluation.

Analytical study

Organoleptic evaluation of Dasamula arka

The colour, odour, taste, and appearance of Dasamula arka were assessed using the sense organs as part of the organoleptic evaluation.

Physicochemical tests conducted on Dasamula arka included determining its pH value, specific gravity, boiling point, refractive index, and HPTLC.

Determination of pH value

The pH value of Dasamula arka was determined potentiometrically using a glass electrode, a reference electrode, and a digital pH meter. [7]

Determination of Specific Gravity

A thoroughly clean and dry pycnometer was taken and weighed. The weight of the pycnometer was taken as (A). It was filled with distilled water, and the weight of the pycnometer filled with distilled water was taken as (B). The pycnometer was emptied completely, then filled with the Dasamula arka sample. The weight of the pycnometer with Arka was taken as (C). Calculation: Specific gravity = C-A/B-A. [8]

Determination of Boiling Point

100 ml of Dasamula arka was placed in the distillation flask, and a few glass beads or another suitable substance was added. The bulb of the flask was placed centrally over a circular hole varying from 3 to 5 cm in diameter (according to the boiling range of the substance under examination) in a suitable asbestos board. The thermometer is held concentrically in the neck of the flask by means of a well-fitting cork in such a manner that the bulb of the thermometer remains just below the level of the opening of the side tube. Heat was applied slowly at first, and when distillation started, heating was adjusted so that Dasamula arka could distil at a constant rate of 4 to 5 ml per minute. The temperature was read when the first drop ran from the condenser and again when the last quantity of liquid in the flask was evaporated.[9]

Determination of Refractive Index

The Abbe's refractometer is convenient for most measurements of refractive index. Hence, Abbe's refractometer was used. To perform a refractive index test, start by gently cleaning both prism surfaces with a volatile solvent like ethanol and a lint-free cloth. Place 3 to 5 drops of your liquid sample onto the lower prism, carefully close and latch the upper prism assembly, and adjust the mirror or light source to illuminate the field. Look through the eyepiece and turn the main measurement knob until you see a clear boundary line separating a light and dark field. If you notice any blurry red or blue colour fringing, turn the dispersion dial to sharpen the border, then fine-tune the knob to align this sharp line precisely with the intersection of the crosshairs. Finally, read and record the refractive index value and the ambient temperature directly from the scales, then promptly clean the prisms again so the instrument is ready for its next use.

Determination of HPTLC

Dasamula arka prepared using both methods was sent to Care Keralam Limited, Kinfra Park, Koratty, Kerala, for HPTLC determination.

OBSERVATION AND RESULTS

Comparative observation of time needed for Dasamula arka formation

The time needed for Arka Yantra for the formation of the first drop of distillate was 25 minutes and it took 1 hour 33 minutes for the completion of distillation. Whereas the distillation apparatus took only 10 minutes to form the first drop of distillate and 31 minutes to complete distillation.

Organoleptic characters of Dasamula arka

Dasamula arka prepared by both methods was clear and transparent, with a distinct aroma and a bitter taste. The one prepared using Arka Yantra had a brown hue, whereas the one prepared using a distillation apparatus was colourless.

Physicochemical properties

pH value: The pH values of Dasamula arka prepared using Arka Yantra and distillation were different, at 4.29 and 3.39, respectively.

Specific gravity: Dasamula arka prepared using Arka Yantra had a value of 0.9915 and, with a distillation apparatus, had the value 0.9921.

Boiling point and refractive index: No significant difference was observed in both; they were 101°C and 1.3315, respectively.

HPTLC fingerprinting profile

HPTLC fingerprinting was done for samples A and B. It was done at two different wavelengths, 254 nm and 366 nm. At 254 nm, the arka prepared using the Arka Yantra showed 4 peaks, while the arka prepared using the distillation apparatus showed 3 peaks. At 366 nm, the Dasamula arka prepared using the Arka Yantra showed 4 peaks, while the Dasamula arka prepared using the distillation apparatus showed only 1 peak.

Table 1: Comparative Observation of Time for Preparation of Dasamula Arka

Sr. No.	Formation of first drop of distillate	Completion of distillation	Total time
Arka Yantra (Batch A)	25 minutes	1 hour 33 minutes	1 hour 58 minutes
Distillation apparatus (Batch B)	10 minutes	31 minutes	41 minutes

Table 2: Organoleptic Characters of Dasamula Arka

Character	Batch A	Batch B
Colour	Brown hue	Colorless
Odour	Sharp	Sharp
Taste	Slightly bitter	Slightly bitter
Appearance	Watery, clear liquid	Watery, clear liquid

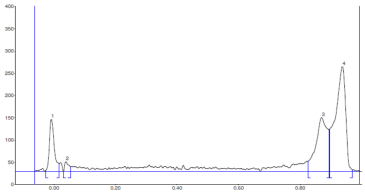
Table 3: Physicochemical parameters of Dasamula arka

Parameters	Batch A	Batch B
pH	4.29	3.39
Specific Gravity	0.9915	0.9921
Boiling Point	101°C	101°C
Refractive index	1.3315	1.3315

HPTLC fingerprinting profile of Dasamula Arka prepared using Arka yantra

Table 4: Peak and area of A1 at 254nm

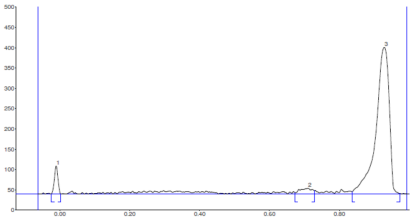
Peak	Rf Maximum	Area	Area %
1	-0.01	1734.6	12.78
2	0.04	268.1	1.98
3	0.87	4211.2	31.03
4	0.94	7356.4	54.21



Graph 1: Graph of HPTLC result of A1 at 254nm

Table 5: Peak and area of A2 at 254nm

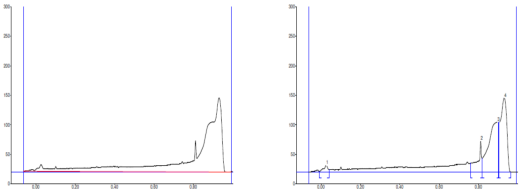
Peak	Rf Maximum	Area	Area %
1	-0.01	647.3	4.67
2	0.71	477.9	3.45
3	0.93	12741.2	91.89



Graph 2: Graph of HPTLC result of A2 at 254nm

Table 6: Peak and area of A1 at 366nm

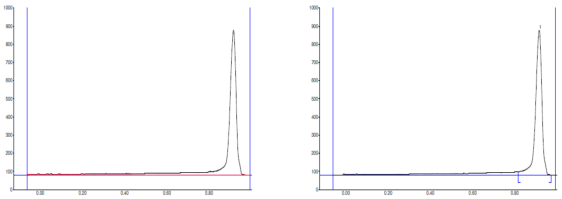
Peak	Rf Maximum	Area	Area %
1	0.03	238.9	2.67
2	0.81	979.1	10.93
3	0.90	3930.5	43.88
4	0.93	3809.6	42.53



Graph 3: Graph of HPTLC result of A1 at 366nm

Table 7: Peak and area of A2 at 366nm

Peak	Rf Maximum	Area	Area %
1	0.92	22413.0	100



Graph 4: Graph of HPTLC result of A2 at 366nm

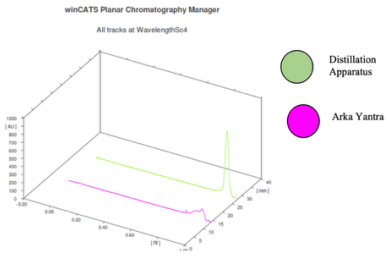


Figure 1: Tracks of A1 and A2 at 366nm

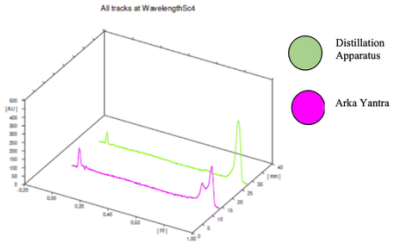


Figure 2: Tracks of A1 and A2 at 254nm

Figure 3: HPTLC plate view of A1 and A2 at 254nm

Figure 4: HPTLC plate view of A1 and A2 at 366nm

Figure 5: Moderately coarse powdered Dasamula taken in the vessel

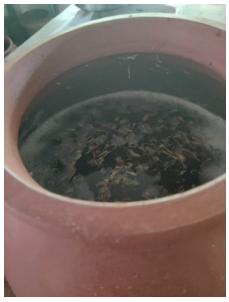


Figure 6: Drugs soaked in water

Figure 7: Arka Yantra with mixture and water

Figure 8: Distillate coming out of the outlet

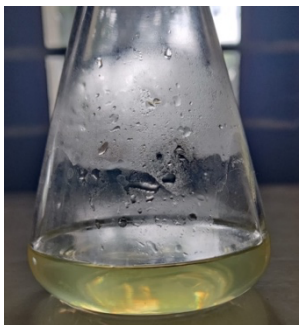


Figure 9: Dasamula Arka prepared using Arka Yantra

Figure 10: Distillation apparatus with the mixture

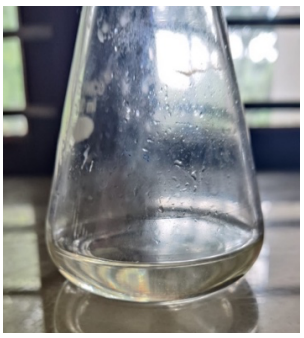


Figure 11: Prepared Dasamula Arka using distillation apparatus

DISCUSSION

Arka Kalpana is described as one among the Panchavidha Kasaya Kalpana in Arka Prakasha. It is a unique Ayurvedic pharmaceutical preparation in which the volatile oil and active principles of a drug are collected by distillation using an Arka yantra or any convenient modern distillation apparatus. In modern pharmaceutics, Arka Kalpana can be compared to distillation. In this study, Dasamula arka prepared using both traditional arka yantra and a modern distillation apparatus showed nearly similar characteristics when evaluated using pharmaceutico-analytical parameters.

Pharmaceutical study

Genuine raw drugs were procured as the initial step of preparing the formulation Dasamula arka. All the drugs were made in coarse form. As per Arka Prakasha, the quantity of water required for soaking the drugs prior to distillation varies based on drug hardness. To aid proper extraction, ten times the amount of water was added for soaking, and the drugs were soaked for 24 hours. There was no indication of spoilage; the Arka had the same smell and colour, and its physicochemical parameters also remained unaltered even after 6 months.

Analytical study

Arka Prakasha of Raavana mentions Ayurvedic parameters to assess the quality of arka. The obtained arka should be more aromatic than the constituent drugs used for its preparation. It should exhibit the same colour as that of the source drug. When the arka is placed in other vessels, it should be almost white like Shankha, Kunda, and Indu. It should also possess the same taste and colour as its constituent drug. All the qualities inherent to a drug should be present in its arka also. [10] The Dasamula arka prepared by both the distillation apparatus and the Arka Yantra fulfilled the characteristics of a Prashastha arka. The only observable difference between the two preparations was that the sample prepared using the Arka Yantra had a slight brown hue, while the preparation obtained using the conventional distillation apparatus remained colourless. This difference may be attributed to the extraction of additional volatile or semi-volatile phytoconstituents during the distillation process in the Arka Yantra, although the exact cause could not be established in the present study.

pH value

The pH value of an aqueous liquid may be defined as the common logarithm of the reciprocal of the hydrogen ion concentration expressed in g per liter. Its value indicates whether a sample is acidic or basic. Dasamula arka was prepared, and its pH was determined as part of the study. The Dasamula arka formulation was found to be acidic. The acidity acts as a natural shield, keeping the medicine fresh without requiring synthetic chemicals.

Specific gravity

The specific gravity of a liquid is the weight of a given volume of the liquid at 25°C (unless otherwise specified) compared with the weight of an equal volume of water at the same temperature, with all weighing being taken in air. This value shows the medicine is highly purified and confirms the presence of volatile essential oils. Because the arka is slightly lighter than pure water, the body can process it readily.

Boiling point

101 degrees Celsius. The boiling point confirms a high concentration of dissolved solute particles thoroughly bound into the liquid. This ensures it is a potent formulation.

Refractive index

The refractive index (η) of a substance with reference to air is the ratio of the sine of the angle of incidence to the sine of the angle of refraction of a beam of light passing from air into the substance. [11] It varies with the wavelength of the light used in its measurement. A refractive index of 1.3315 tells us that the active plant molecules are molecularly dispersed at a highly micro-diluted, safe level.

HPTLC fingerprinting: At 254 nm, the Dasamula arka prepared using the Arka Yantra exhibited four peaks, whereas the

preparation obtained using the conventional distillation apparatus showed only three peaks. The additional peak suggests possible qualitative differences in the chemical profile of the two preparations. However, HPTLC can provide an electronic image of the chromatographic fingerprint and a densitogram to detect marker compounds in a plant sample.[12] But it does not enable definitive identification of the individual phytoconstituents responsible for these variations.

Therefore, comprehensive phytochemical characterisation using advanced analytical techniques such as gas chromatography (GC) or gas chromatography–mass spectrometry (GC–MS) is recommended to identify the compounds responsible for the additional chromatographic peak and the characteristic brown hue observed in the Arka Yantra-prepared sample. Further studies may help explain how the method of distillation affects the phytochemical composition of Dasamula arka and support its standardisation.

Advantages and efficacy of distillation apparatus over Arka Yantra

The efficacy of conventional distillation apparatus is evaluated in terms of minimisation of time required for arka preparation, fuel consumption, environmental pollution, and labour. The time required for the distillation procedure by the traditional method was measured, from preparing the clay to set up the Arka Yantra to completing Arka preparation. The author required almost 3 hours and much labour to set up the Arka Yantra and refill the upper pot as the water evaporated during the process. On the other hand, the distillation apparatus is easily available, and setting up was very easy. Arka yantra took more time to prepare Dasamula arka; its high fuel consumption led to environmental pollution, whereas the conventional distillation apparatus produced no pollution and required less time and fuel.

CONCLUSION

Dasamula arka prepared by the traditional method, Arka yantra, and conventional distillation apparatus are nearly the same in organoleptic character and physicochemical properties. Arka preparation in a conventional distillation apparatus is more convenient than the traditional method using Arka Yantra.

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