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A PHARMACEUTICAL AND PHYSICO CHEMICAL CHARACTERIZATION OF *BHARANGYADI ARKA*

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ABSTRACT

Bharangyadi Yoga, comprised of ten particular herbal ingredients, is a traditional medicinal blend specified in *Sahasrayogam*. Its preparation and consumption typically involve the formulation as a *Kwatha*. Due to the challenges associated with the perishability, taste acceptability, and extended-term storage constraints of *Kwatha Kalpana*, it has been decided to modified it into *Arka Kalpana* for enhanced practicality. The comprehensive pharmaceutical methodology used to produce *Arka* was explored, from the formulation specified in classical texts as *Kashaya* and *Arka* was subjected for evaluation of analytical parameters. The pharmaceutical and storage considerations for enhancing the preservation of volatile components and sustaining the overall quality of the final product were deliberated upon. *Bharangyadi Arka*, as a modified dosage form, offers distinct advantages compared to its original *Kashaya Kalpana*. The *Arka* preparation method not only enhances its self-preserving properties but also ensures organoleptic confirmation by aligning its taste and odour with the ingredients. Additionally, the physico-chemical parameters were analysed to characterize the modified dosage form.

KEYWORDS: *Kashaya Kalpana*, *Bharangyadi Arka*, modified dosage form, analytical parameters.

INTRODUCTION

Ayurvedic pharmaceuticals encompass a wide array of dosage forms, defining the specific medicinal format optimized for patient administration. *Bharangyadi Yoga*, comprised of ten particular herbal ingredients, is a traditional medicinal blend specified in *Sahasrayogam* for managing various types of fever and associated illnesses. Its preparation and consumption typically involve the formulation as a *Kwatha*.[1] However, its short shelf life[2] and large dose[3] pose challenges for patient's compliance. Due to the challenges associated with the perishability, taste acceptability, and extended-term storage constraints of *Kwatha Kalpana*, it has been decided to modified it into *Arka Kalpana* for enhanced practicality.

Kashaya and *Arka*, originating from *Ayurvedic* principles, are two distinct herbal formulations. The preparation of *Kashaya* involves the decoction of aqueous extract process using specified herbal ingredients.[4] While *Arka* is an herbal distillate contains volatile active principles, obtained as a water-based extract through distinctive process using *Arkayantra*,[5] demonstrates an extended shelf life[6] and requires smaller dose.[7]

The present study was conducted to explore the comprehensive pharmaceutical methodology used to produce *Arka* from the formulation specified in classical texts as *Kashaya*. Moreover, it is aimed to assess the physicochemical parameters to ensure the quality of *Arka* as a viable dosage form.

MATERIALS AND METHODS

[A] Pharmaceutical study

The *Bharangyadi Arka* (BHA) was formulated following the general method of preparation outlined in the *Arka Prakasha*.[8]

Ingredients: According to the reference mentioned in *Sahasrayogam*.[1]

Table 1: Ingredients of *Bharangyadi Yoga.*

Sr. no	Ingredients	Botanical source	Part used	Quantity
1	*Bharangi*	*Clerodendron serratum*	Root	1 part
2	*Parpata*	*Fumaria parviflora*	Whole plant	1 part
3	*Shunthi*	*Zingiber officinale*	Rhizome	1 part
4	*Vasa*	*Adhatoda vasica*	Leaf, Stem	1 part
5	*Pippali*	*Piper longum*	Fruit	1 part
6	*Bhunimba*	*Andrographis paniculate*	Whole plant	1 part
7	*Nimba*	*Azadirachta indica*	Stem bark	1 part
8	*Guduchi*	*Tinospora cordifolia*	Stem	1 part

9	*Musta*	*Cyperus rotandus*	Tubers	1 part
10	*Dhanvayas*	*Fagonia cretica*	Whole plant	1 part

Equipment needed: pulverizer, mortar – pestle, sieve, weighing machine, stainless steel vessel and lid, measuring flask, heating mantle, transverse distillation apparatus, volumetric collecting flask.

Material needed: Drug: 1 part (total)

Water: 10 parts

Method of Preparation

Pharmaceutical study of BHA was done at S.D.M. Centre for Research in Ayurveda and Allied Sciences, Udupi.

Whole procedure is divided into following steps.

Purva karma

- Collection of standard raw material: all the raw drugs were used in dry form and collected from SDM Ayurveda pharmacy, Udupi.
- All the needful equipment were arranged and cleaned.
- The raw drugs were cleaned properly.
- Each drug was then separately made into coarse powder (*Yavakuta churna*) using mortar – pestle and pulveriser and it was sieved through mesh no. 8 and stored in airtight container.

Pradhana karma

- Coarse powder of *Bharangyadi Yoga* was put into round bottom flask and 10 parts of water was added to it.
- Closed with stopper and kept for soaking overnight.
- Next day it was kept in heating mantle and that was attached to distillation apparatus.
- Cold water supply was attached to inlet of the condenser.
- Controlled heat was given to the flask. Electric current was used here as a source of heat.
- As the evaporation started, vapor pass through condenser, it was condensed by a cold-water stream and *Arka* getting collected in the collecting flask.
- Once the desired quantity of *Arka* (60%)[9] was collected, then the distillation process was stopped.

Paschat karma

- *Arka* was filled in an air-tight glass bottle for further analytical study.

Fig. 1: *Bharangi.*

Fig. 2: *Parpata.*

Fig. 3: *Sunthi.*

Fig. 4: *Vasa.*

Fig. 5: *Pippali.*

Fig.6: *Bhunimba.*

Fig. 7: *Nimba*

Fig. 8: *Guduchi*

Fig. 9: *Musta.*

Fig. 10: *Dhanvayasa.*

Fig. 11: *Yavakuta churna*, water.

Fig. 12: Process of *Arka* preparation.

Fig. 13 Final product of *Arka*

OBSERVATION

- The colour of water changed to light greenish-brown after soaking the drug into it overnight.
- During distillation, it started to become dark brown.
- At the end of the process, the residue in the flask was neither dried nor burnt. It has some amount of water remaining in it.
- At the beginning of the distillation, it took some time to form the vapor, but later on, it started to be produced continuously.

Precautions Taken

- All the raw drugs and the material/equipment were used after cleaning it properly.
- As the distillation started, firstly collected some amount of distillate was discarded as it does not contain any volatile constituents.
- A continued stream of cold water was maintained for effective cooling of the vapor.
- The lower end of the condenser was tightly fixed to the collecting flask to prevent the escape or any loss of the final product.

[B] Analytical study

Organoleptic analysis: The BHA sample was analyzed for organoleptic characteristics for the parameters of color, odor, taste, consistency.

Physico-chemical analysis was carried out at S.D.M. Centre for Research in Ayurveda and Allied Sciences, Udupi and chromatographic scan, gas chromatography was done at Interstellar Testing Centre Pvt. Ltd., Chennai.

Parameters of Analysis

a) pH value[10]

b) Specific gravity[11]

c) Refractive index[12]

d) Volatile matter

e) Total acidity

f) Viscosity[13]

g) GC-MS[14]

RESULTS

Table 2: Parameters of pharmaceutical process of BHA.

Sr. No.	Parameters	Readings
1	Total quantity of drugs taken	50 gm total (5 gm each)
2	Total quantity of water added	500 ml
3	Time of commencement	9:20 am
4	Vaporization started	10:11 am
5	Characteristic smell of ingredients started	10:23 am
6	Time of completion	2:27 pm
7	Temperature given	50^0 to 65^0 C.
8	Total duration of preparation	5.07 hours
9	Final quantity prepared *Arka*	300 ml

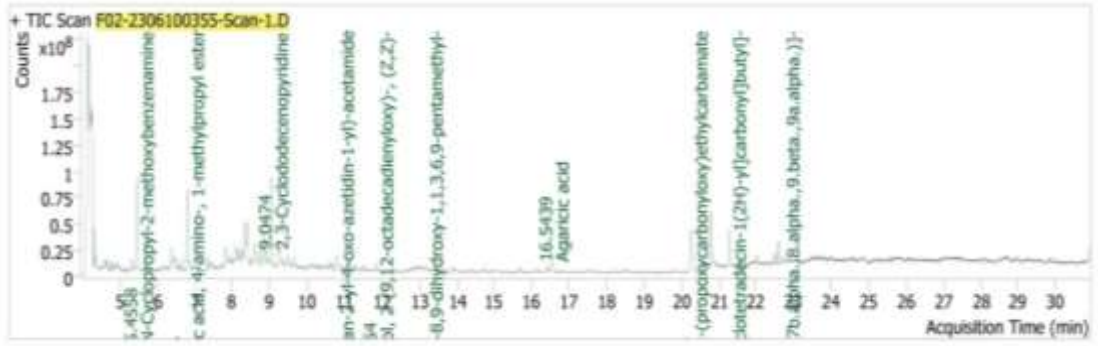
Table 3: Organoleptic characteristics of and BHA.

Characteristics	BHA
Colour	Transparent
Smell	Characteristic
Taste	Prominent – *Tikta* Mild - *Katu*
Consistency	Liquid (watery)

Table 4: Physico-chemical assessment of BHA.

Parameter	Results n = 3% w/w
pH value (m/l)	5.85
Specific gravity (g/cm^3)	0.9680
Refractive index	1.33206
Volatile matter (%)	0.1
Total acidity (g/l)	0.02
Viscosity (Pa S)	1.04

Results of Gas chromatography done for *Bharangyadi Arka*



DISCUSSION

In the study total of 10 herbal ingredients were taken according to the reference mentioned in *Sahasrayogam*[1] in their dry form, ensuring their purity and cleanliness. The formulation comprises drugs with diverse morphological characteristics, which consequently vary the force required to crush them. For instance, the *Bharangi* is tough and challenging to pound manually, but modern techniques make the process easier. On the other hand, the *Pippali* fruit is brittle and readily becomes fine when pulverized.

There are different perspectives on the water-to-ingredient ratio in *Arka Nirmana* (the process of making *Arka*). According to Ayurveda *sara sangraha*, the recommended ratio is 8 parts of water.[9] It is important to use *Yavakuta* (coarse powder) for this process. Larger pieces of dry drugs might impede the penetration of water and extraction of soluble constituents, whereas finer particles may settle down during heating, failing to achieve the required movements. Furthermore, in the distillation apparatus, stirring is not possible as the mouth of vessel is sealed, limiting the agitation of the ingredients during the process.

Subjecting the drug to high heat can result in undesirable outcomes, such as burning of the drug, excessive turbidity in the final collection, color changes, and the presence of unwanted smells. Additionally, volatile principles with low boiling points may decompose if the heat is too intense, making it difficult to initiate vaporization. On the other hand, very low heat might hinder the vaporization process altogether. It is essential to note that the exact temperature for vaporization cannot be standardized for all formulations. It relies on factors like the type of vessel used and the surrounding atmospheric conditions. Therefore, a careful approach is necessary. Gradual heating should be applied until vaporization begins, and then it should be maintained in the low to medium range. In the present study, considering the

aforementioned conditions, a temperature range of 50°C – 65°C was maintained to ensure optimal results. Electric current was used here as a source of heat in this study.

Modern equipment offers the advantage of providing a continuous stream of cold water for condensation, eliminating the need to change water every time the temperature rises.

In this study, 300 ml of *Arka* was collected, which constitutes 60% of the total water added. It is recommended to collect a maximum of 2/3 of the total quantity to avoid the risk of *Kharata* (burning) of the residue. If the heating is prolonged, vapor arising later on may mix with the previously collected *Arka*, potentially spoiling its quality.[9] Therefore, careful adherence to the recommended collection limit is crucial to ensure the best outcome.

Colour change of water after soaking the drugs and during distillation refers to extraction of various pigments and compounds from the drugs.

Upon completion of the process, there was no need for a separate measuring of the final product in this study, as the collecting flask used during the process served as the measuring flask as well. This approach prevented the repeated transferring of *Arka* from the collecting flask to a measuring flask and then into the filling bottle. Such multiple transfers could potentially lead to the loss of volatile principles by exposing the *Arka* to the surrounding atmosphere for extended periods. By avoiding unnecessary transfers, the study ensured better retention of the volatile components and maintained the overall quality of the final product.

The *Arka* was carefully filled into an air-tight glass bottle to safeguard its therapeutic active principles, ensuring both quality and stability. Ideally, *Arka* should be stored in air-tight Amber glass bottles, as this prevents any self-vaporization of its volatile principles due to exposure to sunlight or changing climatic conditions. Using glass as the packaging material is preferable because it is a superior inert material compared to commonly used plastics and metals. Glass ensures the integrity and purity of the *Arka*, minimizing any potential interaction between the product and the packaging material, which could compromise its therapeutic properties. By employing such a storage method, the study prioritized preserving the potency and effectiveness of the *Arka*, ensuring it remains a reliable and high-quality herbal formulation for various medicinal applications. However, additional research and clinical trials are necessary to authenticate and fully understand the therapeutic advantages of *Bharangyadi Arka*.

BHA exhibited distinct color characteristics, transparent with mild turbidity and had a pleasant characteristic smell of *Arka*.

The taste of the *Arka* was described as Prominent *Tikta*, mild *katu*, reflecting the presence of *Tikta Rasa* in the final product.

The difference in consistency between the *Kashaya* and *Arka* can be attributed to the presence of starch. *Kashaya* had a liquid - slightly thick consistency due to the starch content, while the *Arka* had a thinner, water-like liquid consistency. This change in consistency is due the distillation process.

The BHA sample exhibit slightly acidic pH values, has a pH of 5.85. The total acidity value obtained for BHA is 0.02%.

The specific gravity value provides information about the relative density and concentration of the substances in the samples. In the case of the BHA sample, the specific gravity was found to 0.9680 with reference to high water content present in the preparation.

The refractive index of BHA was 1.33206. The refractive index of a drug influences its optical properties, transparency and can be used as a valuable parameter for identification and analysis purposes. That shows the *Arka* is more transparent due to having no solid particles rather than volatile oils and other constituents.

Total of 10 compounds were detected in gas-chromatography of BHA sample.

Table 5: Compounds detected in GCMS.

Sr. no.	Compound name	RT	Match score	Area (%)
1	N-Cyclopropyl-2-methoxybenzenamine	5.45	64.5	18.83
2	1-methylpropyl ester, 4-amino-, Benzoic acid,	6.8	57.8	17.74
3	2,3-Cyclododecenopyridine	9	59.9	22.54
4	N-(2,6-Dimethyl-phenyl)-2-(4-fluoro-phenyl)-2-(2-furan-2-yl-4-oxo-azetidin-1-yl)-acetamide	10.8	50.1	5.62
5	2-(9,12-octadecadienyloxy)-, (Z,Z)- Ethanol	11.85	56.7	2.42
6	2,7,10,11-tetrakis(acetyloxy)decahydro-8,9-dihydroxy-1,1,3,6,9-pentamethyl-4a,7a-Epoxy-5H-cyclopenta[a]cyclopropa[f] cycloundecen-4(1H)-one	13.18	52.7	0.97
7	Agaricic acid	16.54	51.9	5.29
8	Propyl 2-(propoxycarbonyloxy) ethylcarbamate	20.25	52.2	25.44
9	alpha. -(dimethylamino)-N-[2methyl-1-[[3,3a,11,12,13,14,15,15a-	21.28	56.1	12.96

	octahydro-13-(1methylpropyl)-12,15-dioxo-5,8-ethenopyrrolo[3,2b][1,5,8]oxadiazacyclotetradecin-1(2H)-yl]carbonyl]butyl]- Benzenepropanamide			
10	[1aR(1a.alpha.,1b.beta.,4a.beta.,5.beta.,7a.alpha., 7b.alpha., 8.alpha.,9.beta.,9a.alpha.)]-1H-Cyclopropa[3,4]benz[1,2-e]azulene4a,5,7b,9,9a (1aH)-pentol, 3-[(acetyloxy)methyl]1b,4,5,7a,8,9-hexahydro-1,1,6,8-tetramethyl-, 5,9,9a-triacetate,	22.71	53.6	1.26

CONCLUSION

Bharangyadi Arka, a modified dosage form presents advantages over its original *Kashaya Kalpana*. It exhibits a longer shelf life, requires smaller therapeutic doses, and is more feasible to manufacture as it only utilizes water with the formulation *dravya*. Additionally, the *Arka* preparation method imparts self-preserving qualities.

The organoleptic confirmation of extracted active principles in *Bharangyadi Arka* was established by matching its taste and odour with that of the ingredients. Furthermore, the physico-chemical parameters were characterized for this novel dosage form modification.

Conflicts of interest: There are no conflicts of interest.

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