International Journal of Research and Review
www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237

Original Research Article

Pharmaceutico-analytical Study of *Gorakhmundi* (*Sphaeranthus indicus* Linn.) *Kwatha* and *Gorakhmundi Arka*

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ABSTRACT

Introduction: Bhaishajya Kalpana is the branch of Ayurveda which deals with different dosage forms and their therapeutic utility. This is a research oriented study to explore the different pharmaceutical aspects of "Arka Kalpana" and "Kwatha" Kalpana". Gorakhmundi (Sphaeranthus indicus Linn.) is easily available and The Ayurvedic Pharmacopoeia of India has also stated its important formulations, therapeutic uses and chemical constituents, so it was selected for this study.
Aims and objectives: To prepare and study Pharmaceutico-analytical properties of Gorakhmundi arka and Gorakhmundi Kwatha.
Methodology: In this study Gorakhmundi Kwatha was prepared according to the reference found in Sharangadhara Samhita while Gorakhmundi Arka is prepared as per reference in Arka Prakasha. The Pharmaceutical data were observed and recorded. In both the Kalpanas, Gorakhmundi was taken as a common drug, so comparative pharmaceutical and analytical study will be learnt.
Results: Analysis of both prepared medicines was carried out.
Conclusion: The Analytical studies have helped to generate preliminary standards. This study will benefit and add to the pharmaceutical and analytical database of Gorakhmundi Kwatha and Gorakhmundi Arka.

Keywords: Preparation of Gorakhmundi arka, preparation of Gorakhmundi kwatha, analysis of Gorakhmundi arka and Gorakhmundi kwatha.

INTRODUCTION

Ayurveda is regarded as ancient science of life and is based on principle of maintaining the health of a person and relieving the patient from the diseased condition. Bhaishajya Kalpana is the branch of Ayurveda which deals with different dosage forms and their therapeutic utility. Administration of drug in various dosage forms provides an opportunity to the Physician to choose suitable options. To achieve this, different methods were discovered in accordance with the manufacturing process. These are termed as Kalpanas. Kalpana or the formulations are performed to potentiate properties of drugs.

This is a research oriented study to explore the different pharmaceutical aspects of "ArkaKalpana" and "KwathaKalpana". During any pharmaceutical procedure, it is observed that some drugs having volatile oil, as active constituents, loose their potency after heat treatment or exposure to atmosphere. ArkaKalpana was introduced in Ayurveda in later part of development i.e. 12thcentury. By this method, the essential oils can be extracted from the drugs. Arka are distilled essences, which mostly contains

the volatile constituents of the drugs used in the preparation, in a medium of water.

द्रव्यकल्पःपंचधास्यात्कल्कश्चूर्णंरसंतथा।
तैलमर्कक्रमाज्ञेयंयथोत्तरगुणंप्रिये॥
अ.प्र./ प्र.श.४६

According to the above reference, the efficacy of Kalka, Churna, Swaras, Taila and Arka is gradually increasing in ascending order.

Kwatha preparations are one among the Panchavidha Kashaya Kalpana, which are highly effective, but they are to be used when freshly prepared. Gorakhmundi (Sphaeranthus indicus Linn.) is easily available on large scale. Gorakhmundi is mentioned in various classical Ayurvedic and Rasashastra texts. The Ayurvedic Pharmacopoeia of India has also stated its important formulations, therapeutic uses and chemical constituents, so it has been selected for this study. The present study was planned with the aim to study Kwatha and Arka Kalpanas. ArkaKalpana was designed to obtain volatile active principles, which is more in comparison with Kwatha Kalpana, because decoction is prepared out of the drug. The volatile oil in the Arka is medicinally important. Principles for preparation of Kwatha are similar to Arka, so it would be interesting to study both these preparations. Classical Kwatha (decoction) has shorter shelf life. In today's fast lifestyle, sometimes it is not convenient to prepare fresh Kwatha each time while administration. Shelf life of Arka is 6 months[1]. Various dosage forms prepared from the same drug exhibit different pharmacological action. Two different Kalpanas out of the same drug 'Gorakhmundi' were prepared, to study their comparative pharmaceutical and analytical properties.

Gorakhmundi Kwatha is prepared according to the reference found in Sharangadhara Samhita while Gorakhmundi Arka is prepared as per reference in Arka Prakasha.

Study rationale:

a. Very few published works are available on comparative study of Arka Kalpana and Kwatha Kalpana. Various dosage forms prepared from the same drug exhibit different pharmacological action.

b. This study will benefit and add to the pharmaceutical and analytical database of Gorakhmundi Kwatha and Gorakhmundi Arka. In both the Kalpanas, Gorakhmundi has been taken as a common drug, so comparative pharmaceutical and analytical study will be learnt, hence the dissertation topic.

MATERIALS AND METHODS

Plant material - 500 gms bharad (mesh size 20-40) of Gorakhmundi (Sphaeranthus indicus Linn.) fruits containing seeds were procured and authenticated

Pharmaceutical study -

KwathaKalpana: Reference used for the present study is of SharangadharaSamhita (Sha.Sa.Ma.Kha./1-2).

Preparation of GorakhmundiKwatha-

1.50 gms coarse powder (mesh size 20 – 40) of Gorakhmundi was mixed in container having 16 times of water i.e. 800ml of water and boiled with constant heat of Mandagni (low gas flame of 40 – 60^{o}C). Temperature recording was done with help of pyrometer.

2.Heating was stopped after 1/8th of total water remained i.e.100ml.

3.It was allowed to cool down and then filtered in another vessel through fine cloth. It was then kept in air tight container.

4. Three samples of Gorakhmundi Kwatha for clinical study were prepared by the same method described above and labelled as GK1, GK2 and GK3.

Arkakalpana: All the relevant books and Samhitas were reviewed regarding ArkaKalpana. Here, reference used is of ArkaPrakasha.

1. Equipments –

- Horizontal steam distillation apparatus which consist of round bottom flask (borosilicate glass of 500 ml capacity), Leibig condenser (300mm length), receiver adapter bend long, still head (B24 socket and B24 cone), air leak tube (B14 socket and B14 cone), thermometer.

- Electric heating mantle (upto 100^{O} C)
- Two rubber tubes for inlet and outlet of condenser
- Beaker for collection of Arka(of 500 ml capacity)
- Stand with clamps for holding condenser
- Digital weighing machine (max. 200 gms capacity)

Preparation of GorakhmundiArka-

1.At first, coarse powder (mesh size 20 – 40) of Gorakhmundi was soaked in 10 times of water and kept still for 24 hours with vessel closed with cover.

2.Next day, it was transferred to round bottom flask with condenser attached to it and fixed properly.

3.The apparatus was heated with electric heating mantle. Temperature regulation was maintained.

4.When vapours started forming, the tap was opened and continuous cold water flow was started. It liquefied the vapours and output was drained into sink.

5.Arka was collected till it was equal to the half amount of solution that remained. Then further heating was stopped..

6.It was stored in air tight bottle.

Analytical study –

Standardization of final product is a vital factor for availability of its quality and efficacy. It is also necessary in pharmaceutical industry, as good manufacturing practices (GMP) is very important. Keeping this in mind, all attempts have been made to study and analyse the drugs under study. All the three samples of GorakhmundiArka and Gorakhmundi Kwatha were taken up for analysis by employing various parameters like organoleptic characters, physicochemical parameters and chromatographic methods.

RESULTS

(A) Organoleptic Characters:

1. Gorakhmundi (Sphaeranthus indicus Linn.) Bharad

Table 5.1: Organoleptic characters of the Gorakhmundi Bharad sample

Parameter	GorakhmundiBharad sample
Colour	Faint brownish
Odour	Aromatic
Taste	Bitter

2. Three GorakhmundiArka samples (GA1, GA2, GA3)

Table 5.2: Organoleptic characters of the three GorakhmundiArka samples

Parameter	GA1	GA2	GA3
Colour	Colourless	Colourless	Colourless
Consistency	Watery	Watery	Watery
Odour	Aromatic, peculiar smell of Gorakhmundi	Aromatic, peculiar smell of Gorakhmundi	Aromatic, peculiar smell of Gorakhmundi
Taste	Bitter, peculiar taste of Gorakhmundi	Bitter, peculiar taste of Gorakhmundi	Bitter, peculiar taste of Gorakhmundi

All the parameters were same of all the three samples of GorakhmundiArka

3. Three GorakhmundiKwatha samples (GK1, GK2, GK3)

Table 5.3: Organoleptic characters of the three GorakhmundiKwatha samples

Parameter	GK1	GK2	GK3
Colour	Dark brownish	Dark brownish	Dark brownish
Consistency	Watery	Watery	Watery
Odour	Aromatic, peculiar smell of Gorakhmundi	Aromatic, peculiar smell of Gorakhmundi	Aromatic, peculiar smell of Gorakhmundi
Taste	Bitter, peculiar taste of Gorakhmundi	Bitter, peculiar taste of Gorakhmundi	Bitter, peculiar taste of Gorakhmundi

All the parameters were same of all the three samples of GorakhmundiKwatha

(B) Data of Physico-chemical Analysis:

1. Gorakhmundi (Sphaeranthusindicus Linn.) Bharad

Table 5.4: Analytical data of GorakhmundiBharad sample

Parameter	Result obtained
pH	6.02
Loss on drying at 110^{o}C	1.24%
Total Ash value	13.48%
Water soluble extractive	15.09%

2. Three GorakhmundiArka samples (GA1, GA2, GA3)

Table 5.5: Comparative analytical data of GorakhmundiArka sample

Parameter	GA1	GA2	GA3
pH	4.41	4.39	4.42
Specific Gravity at room temp. (gm/ml)	0.969	0.969	0.970
Total solid content (% w/v)	1.07	1.06	1.06
Volatile oil	Present	Present	Present

3. Three GorakhmundiKwatha samples (GK1, GK2, GK3)

Table 5.6: Comparative analytical data of GorakhmundiKwatha sample

Parameter	GK1	GK2	GK3
pH	6.14	6.11	6.15
Specific Gravity at room temp. (gm/ml)	0.983	0.981	0.983
Total solid content (% w/v)	7.09	7.07	7.08
Volatile oil	Present	Present	Present

(C) Data of Chromatographic analysis:

Thin Layer Chromatography-

The TLC study was carried out by using the following condition.

Adsorbent layer - Silica gel $G_{60}F_{254}$

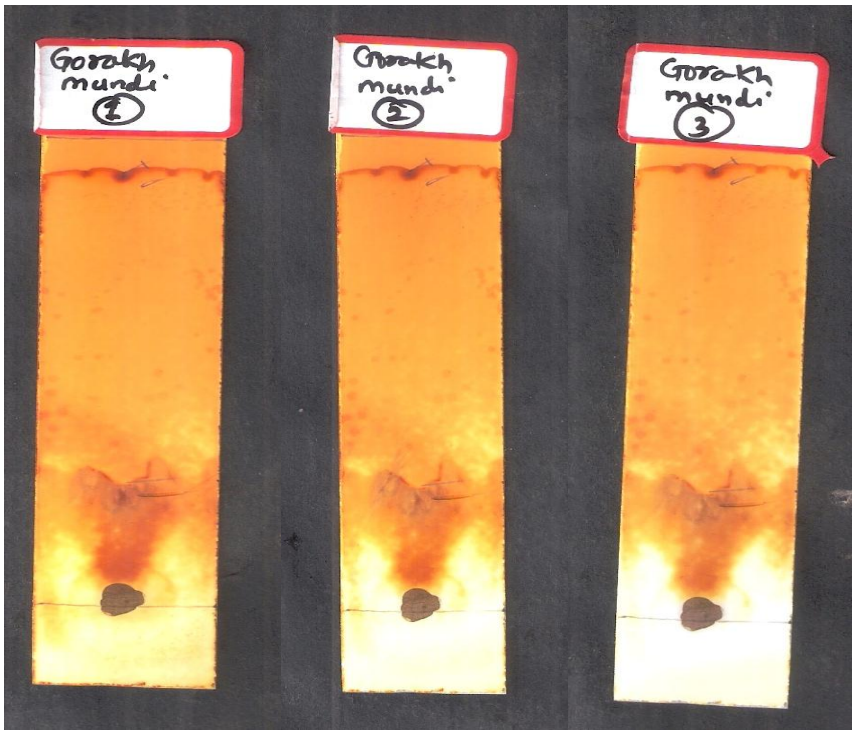
Mobile phase - Toluene: Ethyl acetate: Formic acid (5:4:1)

a. GorakhmundiKwatha

Table 5.7: TLC pattern of the three samples of GorakhmundiKwatha

	Spots (Rf value)	Sample 1	Sample 2	Sample 3
TLC	1	0.92	0.90	0.92
UV 254nm	1	0.92	0.90	0.92
UV 365nm	1 2	0.92 0.89	0.90 0.88	0.92 0.87
Iodine	1 2	0.92 0.89	0.90 0.88	0.92 0.87

They were slightly different



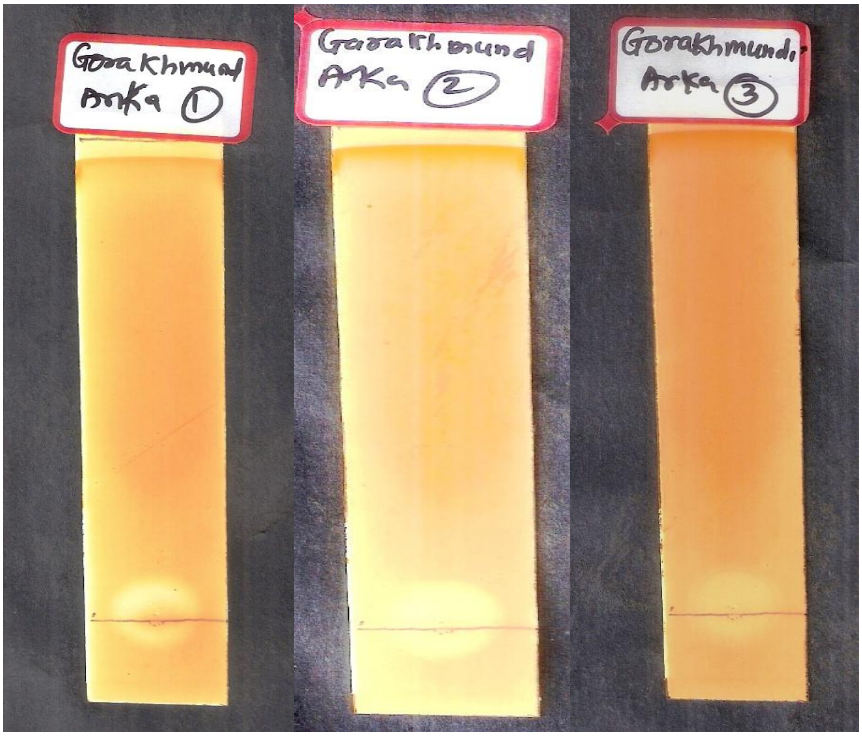
Sample GK1 Sample GK2 Sample GK3

Image 5.1: TLC of Gorakhmundi Kwatha (Sample GK1, GK2, GK3)

b. GorakhmundiArka

Table 5.8: TLC pattern of all the three samples of GorakhmundiArka

	Spots (Rf value)	Sample 1	Sample 2	Sample 3
UV 365nm	1	0.99	0.99	0.99
Iodine	1	0.99	0.99	0.99



Sample GA1 Sample GA2 Sample GA3

Image 5.2: TLC of Gorakhmundi Arka (Sample GA1, GA2, GA3)

Gas Chromatography –

The GC study was carried out by using the following condition -

Mobile phase – Methanol

Toluene: Ethyl acetate: Formic acid (5:4:1)

Run time – 22.571 min

Identified peaks - 13

Rejected peaks - 2

Graph 5.12 : GC results of Gorakhmundi (Sphaeranthus indicus)

Table 5.9 : GC results of Gorakhmundi (Sphaeranthus indicus Linn.) bharad

Peak No.	Retention time (min)	Time offset (min)	Separation code
1	22.8722	2.665	94026
2	12.9439	2.838	53211
3	53.7887	3.293	221122
4	2.4363	17.168	10016
5	1.0899	17.933	4481
6	0.3472	19.983	1428
7	2.9712	20.941	12214
8	1.8244	21.153	7500
9	0.3736	21.228	1536
10	0.7672	21.804	3154
11	0.5853	22.360	2406

DISCUSSION

The project was specially designed for the pharmaceutical preparation and analytical study of GorakhmundiKwatha and GorakhmundiArka. Observations and results of both were noted down, to evaluate the difference in their organoleptic and physico-chemical analysis. In the conceptual study, KwathaKalpana, ArkaKalpana, drug review and analytical review are explained.

Preparation of GorakhmundiArka:

The main reference book of ArkaKalpana is "ArkaPrakasha". The numbers of Arka formulations were found to be highest in ArkaPrakasha. In Unani system of medicines, many preparations have been explained. They considered it more potent than Kashaya. GorakhmundiArka was prepared with reference to ArkaPrakasha.In today's pharmaceutics, the process of Arkapatana can be compared to distillation. Since the classical "Arkapatanayantra" has several draw backs such as difficulty in getting raw materials and Mrutika to manufacture yantra, easily breakable, leakage of vapour, etc. the preparation of Arka is preferred in distillation apparatus.

Distillation exploits the differences in the volatility of the solution's components, which means that every compound has a different boiling point and starts to vaporize at a different temperature. While distilling, the vaporized component in the gaseous state can be collected in a different container by condensation and it is called distillate. In the present study, GorakhmundiArka was prepared in horizontal steam distillation apparatus.

Advantages of distillation apparatus –

1. Temperature regulation can be done.
2. It is transparent. So amount of Arka collected in receiver can be known.

Horizontal steam distillation apparatus is utilized to extract "Arka" in small quantity.

-Coarse powder (mesh size 20-40) of the drug (Gorakhmundi) is required for this Kalpana.

-Coarse powder of the drug is soaked in 10 times of water for 24 hrs (overnight). This increased duration of contact of drug with water makes the drug soft and after boiling, Arka can be easily extracted out of it.

-Temperature control is an important factor in extraction of Arka.

-Condensation was done by continuous flow of water, which produced drops of Arka at receiving end. Its rate of collection of drops was noted down.

By keeping all this in mind, 6 pilot experiments were done with variations in temp. pattern. Out of this, 6th pilot experiment was selected for actual pharmaceutical work as the sample was more aromatic in odour and taste than previous one. Total three samples of final product i.e. GorakhmundiArka were prepared and further subjected to analytical study.

Preparation of GorakhmundiKwatha:

Coarse powder of Gorakhmundi was taken and 16 times of water was added to it. Mild heat was given and Kwatha was prepared. Heating was stopped when 1/8th of total content remained. As time passed, colour of liquid changed from light brown to dark brown while heating. While preparing Kwatha, the patra was not closed as it will become hard to digest. The vapours which are collected in the lid will fall down and get diluted with Kashaya. So while preparing Kwatha, the vessel was kept uncovered.

Total three samples of final product i.e. GorakhmundiKwatha were prepared and further subjected to analytical study.

Analytical study:

a) Organoleptic characters -

Table 6.1: Organoleptic Characters:

	GorakhmundiBharad	GorakhmundiKwatha	GorakhmundiArka
Sparsha	Rough	Watery	Watery
Rupa	Faint brownish	Dark brownish	Colourless
Rasa	Bitter	Bitter+	Bitter++
Gandha	Aromatic	Aromatic	Aromatic++

b) Physicochemical tests -

1. pH - The pH of GorakhmundiArka sample GA1, GA2, GA3 was 4.41, 4.39, 4.42 respectively, while that of GorakhmundiKwatha sample GK1, GK2, GK3 was 6.14, 6.11, 6.15 respectively. This shows that Arka is slightly acidic in nature than Kwatha. Changes might have occurred due to gradual oxidation process. Absorption, efficacy, irritability, etc. will depend on the pH of the substance. If the substance is very acidic or very alkaline, it causes irritation to the tissues. So dose of Arka is less as compared to its Kwatha.

2.Total solid content - It determines the amount of solids remaining after heating the sample at $105^{O}C$ to constant weight. It denotes how much water soluble constituents are present in the sample. In Kwatha, it denotes how potent it is. Here, total solid varies from 7.09, 7.09 and 7.08 of Kwatha sample GK1, GK2, GK3 respectively. Total solid content of Arka varies from 1.07, 1.06. 1.06 of Arka sample GA1, GA2, GA3 respectively. So, it is less as compared to Kwatha. It may be due to Arka containing water and volatile distribution which evaporates when heat is applied.

3. Specific gravity – It indicates the presence of solutes in a solvent. The presence of dissolved substances changes the value of specific gravity. Specific gravity of GorakhmundiArka sample GA1, GA2, GA3 was 0.969, 0.969,0.970 respectively and of Kwatha sample GK1, GK2, GK3 was 0.981, 0.983 and 0.981 respectively. If any particles either dissolved or suspended are present with Kwatha, the determination of specific gravity and total solid may go to higher side. The prepared Kwathagoes through aqueous extraction procedure where water is used as solvent.

4. Thin layer chromatography - It was used as guide for this research work. It provided qualitative analysis of active constituents present in GorakhmundiArka and Kwatha. Mobile phase was kept same for both. All the samples of GorakhmundiArka showed unique dark spot at same Rf value i.e. 0.99. It was seen at UV 365 nm and iodine chamber. All the samples of Gorakhmundi Kwatha showed slightly different spots at different Rf value. In TLC it showed at 0.92, 0.90 and 0.92 of sample GK1, GK2, GK3 respectively. In UV 254 nm, it showed the same as in TLC chamber. In UV 365 nm it showed two spots. First spot was same as above. Second spot was seen at 0.89, 0.88 and 0.87 of sample GK1, GK2, GK3 respectively. The difference in Rf value may be due to number of factors like temperature, layer thickness, moisture on TLC plate, solvent parameters and depth of mobile phase.

5. Gas Chromatography –It was done to identify peaks at different retention time. Total 13 peaks were detected, out of which, three were prominent. It was seen at 2.665min, 2.838min and 3.293min.

These analytical parameters i.e. pH, specific gravity, total solids, TLC, Gas Chromatography support the quality of Gorakhmundi Arka and Gorakhmundi Kwatha. There was not much difference in organoleptic and physico-chemical characters of respective different samples of Kwatha. Likewise, there was not much difference in organoleptic and physico-chemical characters of respective different samples of Arka.

The data of the analysis clearly shows that there is not considerable difference in the values of different parameters like specific gravity, TLC of different samples of Gorakhmundi Kwatha and Gorakhmundi

Arka except in pH and total solid content where significant difference was seen.

CONCLUSION

Pharmaceutical Study:

1.Classical references regarding ArkaKalpana are not available up to Samhita period. In modern era, the Ayurvedic texts like ArkaPrakasha and Ayurved Saar Sangrahahas mentioned Arkakalpana systematically. For preparing GorakhmundiArka, use of horizontal steam distillation apparatus may be suggested due to its performance and qualification, economically.

2. Classical references regarding Kwatha Kalpana are very prominent in all periods of Ayurvedic literature. Gorakhmundi Kwatha was prepared according to the reference found in Sharangadhara Samhita.

Analytical Study:

1. The evolved data will be very useful for the standardisation and routine analysis of both Gorakhmundi Kwatha and Gorakhmundi Arka.

2. The data of the analysis clearly shows that there was not much difference in the values of different parameters of the respective three samples of Kwatha. Likewise, there was not much difference in the values of different parameters of the respective three samples of Arka.

3. The data of the analysis clearly shows that there is not considerable difference in the values of different parameters like specific gravity, TLC of different samples of GorakhmundiKwatha and Gorakhmundi Arka except in pH and total solid content.

- Chemically, pH showed Arka is slightly acidic in nature than Kwatha.
- In TLC test, GorakhmundiArka showed unique dark spot at same Rf value in UV 365 nm and iodine chamber. GorakhmundiKwatha showed slightly different spots at different Rf value. It was seen in UV 254 nm, UV 365 nm and iodine chamber.
- Total solid content of Arkais less as compared to Kwatha. It may be due to Arka containing water and volatile distribution which evaporates when heat is applied.
- There was not much difference in specific gravity of Kwatha and Arka.

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How to cite this article: Rajadhyaksha SP, Dhage VS. Pharmaceutico-analytical Study of gorakhmundi (sphaeranthus indicus Linn.) kwatha and gorakhmundi arka. International Journal of Research and Review. 2019; 6(12):456-463.

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