

Analytical Study of Ajmoda (*Carum roxburghianum* Benth.) Distillate by Traditional and Clevenger Methods

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ABSTRACT

Introduction: *Ajmoda* (*Carum roxburghianum* Benth.), a valued Ayurvedic herb, is frequently used for its digestive and respiratory benefits. The present study was undertaken to bridge the gap between classical Ayurvedic knowledge and modern scientific validation by standardising and analysing *Ajmoda Arka* prepared by both traditional and Clevenger methods.

Aim: To prepare and analyse the physicochemical and microbiological parameters in *Ajmoda arka* prepared by using traditional and Clevenger methods.

Materials and Methods: The present experimental comparative analytical study was held in Rasashala of Mahatma Gandhi Ayurved College, Hospital and Research Centre Wardha, Maharashtra, India from October to November 2024. *Ajmoda Arka* was prepared by soaking Ajmoda seeds in water and distilling using both traditional and Clevenger apparatus. The resulting samples were analysed based on organoleptic,

physicochemical, and microbiological parameters to ensure quality and efficacy.

Results: Both samples (prepared by traditional and Clevenger methods) exhibited similar organoleptic properties: they were colourless, aromatic, and had a characteristic taste. Physicochemical analysis showed identical refractive indices (1.39) for both samples, with slight variations in specific gravity (0.981 for traditional and 0.958 for Clevenger) and pH (8.06 for traditional and 7.9 for Clevenger). Microbiological testing confirmed the absence of total viable count, *Enterobacteriaceae*, total fungus count, *E.coli*, Salmonella, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* in both samples.

Conclusion: *Ajmoda Arka* prepared by both traditional and Clevenger methods adhere to the quality standards expected of Ayurvedic formulations. This study not only validates traditional preparation methods but also provides a foundation for future standardisation and research in Ayurvedic pharmaceuticals.

Keywords: *Ajmoda arka*, *Arka kalpana*, Digestive benefits, Microbiological parameters

INTRODUCTION

The *Pancha Vidha Kashaya Kalpanas* [1] (five types of medicine preparation), comprising *Swarasa* (expressed juice), *Kalka* (herbal paste), *Kwatha* (decoction), *Hima* (cold infusion), and *Phanta* (hot infusion), represent the essential techniques in Ayurvedic medicine preparation. These five methods serve as the basic framework for creating various medicinal concoctions within the practice of Ayurvedic pharmaceuticals (*Bhaishajya Kalpana*). Ravana, the author of *Arka Prakasha*, identifies *Arka Kalpana* as one of the *Pancha Vidha Kashaya Kalpanas* [2].

Ajmoda Arka is a significant formulation in Ayurveda, utilised for treating a variety of diseases [3]. It is renowned for its digestive and carminative properties [4], and it is commonly used to treat various gastrointestinal and respiratory issues. To date, no pharmaceutical research has been conducted on *Ajmoda Arka*. This formulation is prepared according to the guidelines in *Arka Prakasha* [2].

Carum roxburghianum Benth. commonly known as *Ajmoda* [5], is an aromatic spice and a winter crop. It belongs to the *Apiaceae* (*Umbelliferae*) family and is one of the 192 species within the *Carum* genus found worldwide. *Ajmoda* is a versatile plant valued for its aromatic seeds, which are an integral part of various culinary and medicinal traditions [6]. *Ajmoda* is highly valued in Ayurveda for its wide range of medicinal uses, particularly in the treatment of digestive and respiratory ailments [7]. In Ayurveda, the dosage and method of use depend on the individual's constitution (*Prakriti*) [8], the specific condition being treated, and the formulation being used. *Ajmoda* can be used in various forms such as powder, decoction, or oil [9].

In this study, a thorough evaluation of the preparation of *Ajmoda Arka* was conducted in accordance with the Standard Operating Procedure (SOP). This involved examining relevant phytochemical parameters, which may significantly enhance the current understanding. The comparison between the traditional and Clevenger methods was essential to evaluate differences in yield, quality, and standardisation of *Ajmoda Arka*. As traditional methods are often time-consuming and lack precise control, the study aimed to assess whether the modern Clevenger apparatus could offer a more efficient and reproducible alternative without compromising therapeutic efficacy.

Analytical studies on Ayurvedic drugs are essential to ensure quality and standardisation amid rising demand and limited raw materials. Chemical analysis helps identify constituents, set benchmarks and improve formulations. Hence, present study was conducted to prepare and compare the physicochemical and microbiological parameters in *Ajmoda arka* prepared by using traditional and Clevenger methods.

MATERIALS AND METHODS

The present experimental comparative analytical study was held in Rasashala of Mahatma Gandhi Ayurved College, Hospital and Research Centre Wardha, Maharashtra, India. This study was conducted in the month of Octoberber 2024 till November 2024.

Study Procedure

Preparation of *Ajmoda Arka*

- In *Arkaprakash* of *Ravana Samhita*, preparation of *Arka* was discussed along with the use of *Arkayantra* [9], a device

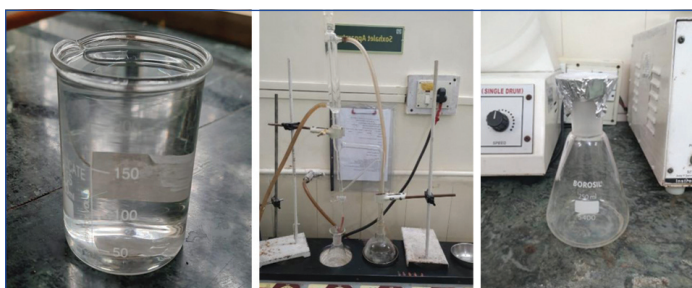
associated with *Arka* preparation. *Ajmoda arka* was prepared by two methods, first by traditional method [2] and second by clevenger method [10].

- *Ajmoda* seed (100 gm) [Table/Fig-1] were washed to remove any impurities or dirt. *Ajmoda* seeds were brought from local vender of Wardha. Seeds were soaked in 1000 mL of water overnight.
- Half seeds were used to prepare *Arka* by traditional method, around 250 mL *Arka* was prepared [Table/Fig-2,3]. Clevenger apparatus was assembled according to manufacturer's instruction and was ensured that there was no leakage. Transfer the soaked seeds along with the water into the distillation flask. Heat the distillation flask gradually. The water will begin to boil, and steam will carry the volatile oils and other compounds from the seeds. As the steam ascends, it moves through the condenser [Table/Fig-4], where it cools and transforms back into liquid form. The Clevenger apparatus separated the volatile oils from the water. The distillate (*Arka*) was collect in the collection vessel [Table/Fig-5].



[Table/Fig-1]: *Ajmoda* seeds.

[Table/Fig-2]: *Arka* Preparation by traditional Method. (Images from left to right)



[Table/Fig-3]: Prepared *Arka* by traditional method.

[Table/Fig-4]: Soxhalet apparatus.

[Table/Fig-5]: Prepared *arka* by clevenger method/. (Images from left to right)

ANALYTICAL PARAMETERS

Analysis were carried out at Cotex Laxmi Healthcare Private Limited MGAC, Salod (H), Wardha, Maharashtra, India. Analytical investigation was undertaken to suggest suitable parameters and their expected values for the regular quality assessment of the following samples.

Sample 1: *Ajmoda arka* 1 (by traditional method)

Sample 2: *Ajmoda arka* 2 (by clevenger method)

The two samples were examined using the following criteria [11]:

I. Organoleptic Parameters The consistency (*Sparsha*), colour (*Rupa*), taste (*Rasa*), and odour (*Gandha*) of both samples were evaluated. These characteristics align with the examination by the five sense organs (*Panchagyanedriya Pariksha*) [12] in Ayurveda. These various organoleptic characteristics offer insights into the authenticity of the sample for both the physician and the patient. They provide an initial assessment of the quality of different formulations without the need for chemical tests.

II. Physicochemical Parameters:

- **Determination of specific gravity-** Specific gravity (relative density) is the ratio of a substance's density to that of a reference, typically water at 4°C for solids and liquids. For liquids, it is the ratio of a liquid's weight to an equal volume of water at a specified temperature, usually 25°C [13].
- **Determination of refractive index-** The refractive index (n) is the ratio of the speed of light in a vacuum to its speed in a medium, influencing light behaviour. It is essential in optics, impacting lens and fiber designs, and is used in refractometry to measure solution concentrations [14].
- **Determination of pH-** pH indicates whether a solution is acidic, neutral, or alkaline and is crucial for stability and physiological compatibility in pharmacopoeial substances. Measured using a pH meter, it involves a glass electrode sensitive to hydrogen ions and a calomel reference electrode.

III. Microbiological parameters Microbiological parameters refer to various aspects related to microorganisms, their growth, and their impact on a particular system or environment. In the context of products like pharmaceuticals, food, or cosmetics, microbiological parameters are critical for assessing safety, quality, and efficacy. Some common microbiological parameters include:

Total Viable Count (TVC): Total Viable Count (TVC) quantifies the total number of viable microorganisms, including bacteria, yeast, and mould, found in a sample. It provides an indication of the overall microbial load and is used to evaluate product hygiene and storage conditions.

Pathogenic microorganisms: Pathogens such as *Salmonella*, *Escherichia coli* (*E. coli*), *Staphylococcus aureus* and moulds like *Aspergillus* and *Penicillium* can pose serious health risks if present in products. Testing for these pathogens is crucial for ensuring product safety.

Yeast and mould count: Yeasts and moulds can spoil products and produce toxins harmful to human health. Monitoring their presence helps prevent contamination and maintain product quality.

Specific microbial tests: Depending on the type of product, specific microbial tests may be conducted. For example, in pharmaceuticals, tests for specific strains of bacteria or fungi may be required as per regulatory guidelines.

STATISTICAL ANALYSIS

The data was analysed using descriptive statistics.

RESULTS

Both Sample 1 and Sample 2 exhibit similar organoleptic properties mentioned in [Table/Fig-6], being colourless, aromatic, and having a characteristic taste.

S. No.	Parameters	<i>Ajmoda Arka</i> by traditional method	<i>Ajmoda Arka</i> by Clevenger method
1.	Colour	Colourless	Colourless
2.	Odour	Aromatic	Aromatic
3.	Taste	Characteristic	Characteristic

[Table/Fig-6]: Organoleptic parameters of the samples.

Physicochemically, they have identical refractive indices (1.39), but sample 1 has a slightly higher specific gravity (0.981) and pH (8.06) compared to Sample 2 (0.958 and 7.9, respectively) [Table/Fig-7].

S. No.	Parameters	Sample 1	Sample 2
1.	Specific gravity	0.981	0.958
2.	Refractive index	1.39	1.39
3.	pH	8.06	7.9

[Table/Fig-7]: Physicochemical parameters of the samples.

Microbiologically, both samples show absence of total viable count, *Enterobacteriaceae*, total fungus count, *E. coli*, *Salmonella*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* [Table/Fig-8].

S. No.	Parameters	Sample 1	Sample 2
1.	Total viable count	Absent	Absent
2.	Total fungus count	Absent	Absent
3.	<i>Enterobacteriaceae</i>	Absent	Absent
4.	<i>E.coli</i>	Absent	Absent
5.	<i>Salmonella</i>	Absent	Absent
6.	<i>Staphylococcus aureus</i>	Absent	Absent
7.	<i>Pseudomonas aeruginosa</i>	Absent	Absent

[Table/Fig-8]: Microbiological parameters of the samples.

DISCUSSION

The present study focused on the preparation and analysis of *Ajmoda Arka*, an Ayurvedic formulation traditionally used for treating ailments such as backache, joint pain, cough, and to enhance appetite. The preparation was carried out following the classical reference from *Arka Prakasha*, employing both traditional and clevenger methods. The analytical investigation included organoleptic, physicochemical, and microbiological parameters to ensure the quality and efficacy of the formulation. Until now, no analytical studies had been conducted on *Ajmoda Arka*.

Ajmoda Arka was prepared using two methods as the traditional method and the clevenger method. Half of the seeds were used to prepare Arka traditionally, yielding about 250 mL. In the Clevenger method, the soaked seeds with water were distilled using the apparatus, where steam carried volatile oils through a condenser. The condensed liquid was collected as Arka, with the apparatus effectively separating volatile oils from water.

Both *Ajmoda Arka* samples (traditional and Clevenger methods) were colourless, aromatic, and had a characteristic taste. Physicochemical analysis showed identical refractive indices (1.39), with Sample 1 having slightly higher specific gravity (0.981) and pH (8.06) than Sample 2 (0.958 and 7.9). Microbiological evaluation confirmed the absence of all tested pathogens and microbial counts in both samples.

Ajmoda is known to relieve gas and bloating by facilitating the expulsion of gas from the intestines. It promotes appetite and aids in digestion by stimulating the secretion of digestive enzymes. It helps in reducing spasms in the gastrointestinal tract, thereby relieving abdominal pain and discomfort. It can help in widening the bronchi and bronchioles, making it easier to breathe, especially in conditions like asthma. It helps in clearing mucus from the airways, thus providing relief in conditions like cough and bronchitis [15]. It is known to help in managing high blood pressure by relaxing the blood vessels and improving blood flow. It promotes the excretion of urine, which can help in reducing blood pressure and in detoxifying the body [16].

It reduces inflammation in joints and muscles, which can be beneficial in conditions like arthritis and muscle pain. It provides pain relief, particularly in conditions involving joint and muscle pain [6]. It helps in preventing the formation of kidney stones and assists in the elimination of small stones through urine. It increases urine production, which helps in flushing out toxins and excess salts from the kidneys [17]. It can help in modulating the immune response, making it useful in managing autoimmune conditions and enhancing overall immunity [18]. It has a calming effect on the nervous system, which can help in managing stress, anxiety, and insomnia. It strengthens the nervous system and helps in improving nerve function. It is believed to enhance sexual health and performance. It can help in regulating menstrual cycles and alleviating menstrual cramps [19].

Carum roxburghianum possesses potent antimicrobial properties, primarily due to its high thymol content. Its effectiveness against a

broad spectrum of bacteria and fungi makes it a valuable natural antimicrobial agent with applications in food safety, medicine, and traditional health practices [20].

Limitation(s)

The influence of environmental factors such as temperature, humidity, and atmospheric pressure on the distillation process was not assessed, which may impact yield and composition. In present study, detailed phytochemical analysis (such as HPTLC, GC-MS, or LC-MS) was not conducted to identify and quantify active constituents comprehensively no toxicological studies were conducted to assess potential adverse effects or safety limits for prolonged use of *Ajmoda Arka*. The study did not account for variations in the quality of *Ajmoda* seeds due to differences in geographic origin, cultivation practices, or storage conditions, which may influence the final product's composition.

CONCLUSION(S)

Arka Kalpana represents a remarkably distinct formulation within the realm of *Bhaishajya Kalpana*. It is recognised as one of the *Pancha Vidha Kashaya Kalpana* by *Ravana*. *Ravana's* "Arka Prakasha" is the principal authoritative text that comprehensively describes the procedures involved in the production of *Arka Kalpana*. Overall, the analytical parameters confirm that *Ajmoda Arka* prepared by both traditional and Clevenger methods meets the quality standards expected of Ayurvedic formulations. The organoleptic, physicochemical, and microbiological parameters are consistent with the classical texts, ensuring the formulation's safety, efficacy, and acceptability. These findings contribute significantly to the existing knowledge and provide a robust foundation for further research and standardisation in Ayurvedic pharmaceuticals.

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