

Analytical Evaluation and standardization of Trisugandha Arka in Danta Sharkara(Dental Plaque):An Ayurvedic formulation

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Abstract:

Trisugandha Arka is a classical Ayurvedic distillate formulation described in Arka Prakasha, Chaturtha Shataka, 5th verse, containing Twak, Ela and Patra. The formulation is indicated for Mukhadourgandhya and Malabhedana. In the present era, despite the established use of classical Ayurvedic formulations, there is a growing need for their scientific evaluation and standardization to ensure reproducible quality and establish suitable quality-control parameters. The present study was undertaken for the analytical evaluation of Trisugandha Arka to establish its organoleptic, physicochemical and chromatographic parameters.

Materials and Methods: Trisugandha Arka was prepared according to the classical Ayurvedic procedure and subjected to organoleptic evaluation and physicochemical analysis. The analytical parameters included organoleptic characters, specific gravity, viscosity, acid value, unsaponifiable matter, iodine value, rancidity, peroxide value and High Performance Thin Layer Chromatography (HPTLC). Microbial evaluation was also carried out to assess the quality of the formulation.

Results: The analytical evaluation of Trisugandha Arka demonstrated characteristic organoleptic and physicochemical properties. The formulation was found to be colourless with characteristic odour and free from visible particles and growth on clarity assessment. The physicochemical analysis showed a specific gravity of 0.9641, refractive index of 1.33206, pH of 6.0, viscosity of 1.0456, volatile matter of 0.23% and total acidity of 0.18. HPTLC profiling demonstrated distinct chromatographic bands at different R_f values under short UV, long UV and after derivatization.

Conclusion: The present analytical evaluation provides characteristic quality-control parameters and an HPTLC fingerprint profile for Trisugandha Arka. The generated analytical data may serve as a reference for identification, authentication and quality assessment of the formulation and may contribute to its further standardization and batch-to-batch consistency.

Keywords: Trisugandha Arka, Arka Prakasha, analytical study, standardization, physicochemical evaluation, HPTLC.

Introduction:

Oral health is an important component of general health and quality of life. Dental plaque is a structured microbial biofilm formed by the accumulation of microorganisms and food debris on tooth surfaces and is a major contributing factor to gingival inflammation and periodontal disorders. Persistent plaque

accumulation may further contribute to calculus formation, halitosis, gingivitis, periodontitis and dental caries. Hence, effective plaque control is essential for maintaining oral health. The Ayurvedic concept of dental deposits is described under Danta Mala and Dantaśarkarā. Improper cleansing of the teeth leads to accumulation of Mala over the dental surfaces, which, with prolonged neglect and drying, may undergo hardening and form Dantaśarkarā. In the present context, Dantaśarkarā may be correlated with dental plaque and calculus based on their characteristic accumulation over the tooth surfaces. The classical management emphasizes Danta Nirlekhana for removal of these deposits while protecting the dental and gingival tissues. This can be correlated with mechanical dental scaling in contemporary dentistry.

Although scaling effectively removes existing deposits, plaque may undergo microbial recolonization subsequently, necessitating supportive measures for maintaining oral hygiene. Mouthrinses provide direct contact of the medicament with the teeth, gingiva and other oral surfaces and may therefore serve as a useful adjunct following mechanical plaque removal. The Ayurvedic procedures of Kavala and Gandusha also highlight the therapeutic importance of local administration of medicinal preparations within the oral cavity.

Trisugandha Arka is a classical Ayurvedic formulation described in Arka Prakasha, Chaturtha Shataka, 5th verse, prepared from Twak, Ela and Patra. It is described for Mukha Daurgandhya and Mala Chedana, providing a classical basis for its consideration in oral cleansing and maintenance of oral hygiene. The Arka dosage form, being a liquid distillate, facilitates uniform contact with the oral surfaces and provides a suitable form for administration as a mouthrinse.

Considering its classical indication for Mala Chedana and Mukha Daurgandhya, along with the therapeutic relevance of its constituent drugs, Trisugandha Arka was selected for the present study as an adjunct to Danta Nirlekhana. To ensure quality, identity and reproducibility of the formulation, the present study was undertaken to evaluate its organoleptic, physicochemical, chromatographic and microbiological parameters and to establish preliminary analytical standards for Trisugandha Arka.

MATERIALS AND METHODS:

Analytical Evaluation of Trisugandha Arka

The prepared sample of Trisugandha Arka was subjected to systematic analytical evaluation at the Sri Dharmasthala Manjunatheshwara Centre for Research in Ayurveda and Allied Sciences, Udupi. The analytical assessment included organoleptic evaluation, clarity test, determination of volatile matter, specific gravity, refractive index, pH, viscosity, total acidity and High Performance Thin Layer Chromatography (HPTLC).

Organoleptic Evaluation

The organoleptic characteristics of Trisugandha Arka were evaluated by sensory examination. The colour, odour and taste of the formulation were assessed and documented.

Clarity Test

Clarity was assessed by visual inspection under adequate illumination. The sample was observed against black and white backgrounds with gentle swirling to detect visible particulate matter or other extraneous growth.

Determination of Volatile Matter

Ten millilitres of Trisugandha Arka were extracted twice with 20 mL of n-hexane. The n-hexane-soluble fraction was collected in a pre-weighed china dish and evaporated at room temperature. The difference in weight was recorded and the volatile matter was calculated.

Determination of Specific Gravity

A specific gravity bottle was cleaned with acetone followed by ether, dried and weighed. The bottle was filled with the test sample at room temperature, stoppered and weighed after removal of excess liquid. The procedure was repeated using distilled water in place of the sample, and the specific gravity was determined from the respective weights.

Determination of Refractive Index

The refractive index was determined using a refractometer at 29°C. The instrument was standardized using distilled water, with a refractive index of 1.33206 at 29°C. One drop of Trisugandha Arka was placed on the prism and the reading was recorded after applying the required correction for instrumental error.

Determination of pH

Standard buffer solutions of pH 4, 7 and 9.2 were prepared in distilled water. Ten millilitres of Trisugandha Arka were diluted to 100 mL with distilled water, stirred thoroughly and filtered. The pH meter was calibrated using the standard buffer solutions and the pH of the sample filtrate was recorded. The measurement was repeated four times and the average value was considered as the result.

Determination of Viscosity

Viscosity was determined using a U-tube viscometer. The time required for the sample and water to pass between the specified marks of the viscometer was recorded. The viscosity of the sample was calculated using the relationship between the density and flow time of the sample and the reference liquid.

Determination of Total Acidity

One gram of the sample was dissolved in 75 mL of carbon dioxide-free water and titrated against standard sodium hydroxide solution using 4–6 drops of phenolphthalein as indicator. Titration was continued until a persistent pink colour was obtained for approximately 10 seconds. Total acidity was calculated using the specified titration formula.

High Performance Thin Layer Chromatography (HPTLC)

Ten millilitres of Trisugandha Arka were extracted with 20 mL of n-hexane. Aliquots of 4, 8 and 12 μ L of the extract were applied onto pre-coated silica gel F254 aluminium plates as 7-mm bands using a Linomat 5 TLC applicator. The plate was developed using Toluene:Ethyl acetate (8:2) as the mobile phase. The developed plate was visualized under short UV and long UV and subsequently derivatized with vanillin sulphuric acid. The chromatographic profile was observed at 254 nm, 366 nm and 620 nm following derivatization. The R_f values, spot colours and densitometric profiles were recorded.

RESULTS:

The analytical evaluation of Trisugandha arka demonstrated characteristic organoleptic properties and defined physicochemical parameters. The results obtained from the analytical evaluation are presented in Table 1.

Parameter	Result
Colour	Colourless
Odour	Characteristic
Clarity	Free from visible particles and growth
Volatile matter	0.23
Specific gravity	0.9641
Refractive index	1.33206

PH	6.0
Viscosity	1.0456
Total acidity	0.18

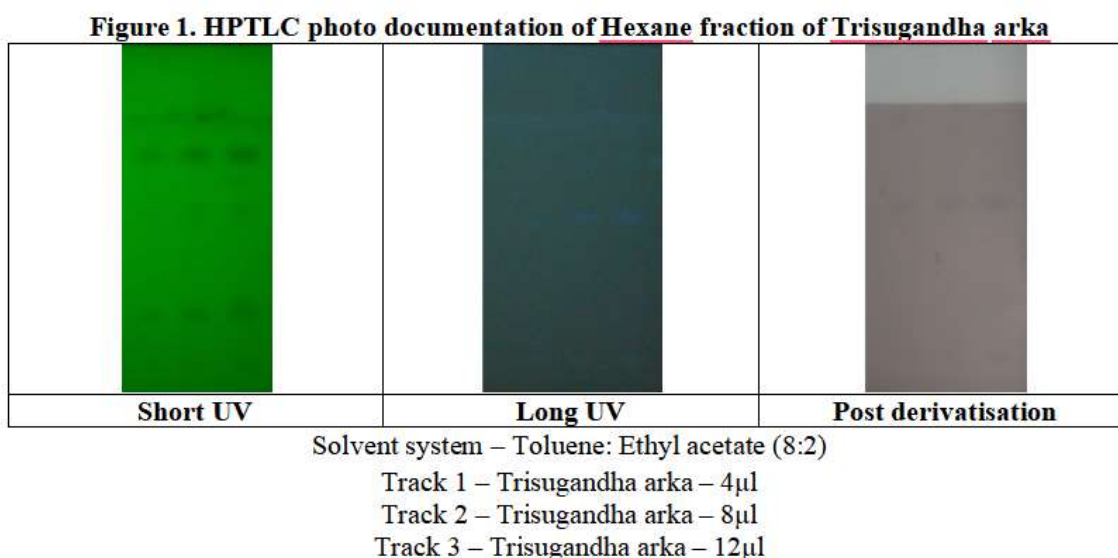
HPTLC Profile of Trisugandha Arka

HPTLC analysis of the n-hexane fraction of Trisugandha Arka was carried out using Toluene:Ethyl acetate (8:2) as the mobile phase. The chromatographic profile showed distinct bands under short UV and long UV, with further visualization after derivatization with vanillin sulphuric acid. The observed R_f values and corresponding colours are presented in Table 2.

Table 2.HPTLC Profile of Trisugandha Arka

RF Value	Short UV	Long UV	After derivatization
0.21	Green	-	-
0.66	Green	Fluorescent blue	Purple
0.88	Green	-	-

Figure 1.HPTLC Chromatographic profile of Trisugandha Arka



Densitometric analysis

Densitometric scanning of the Trisugandha Arka extract demonstrated distinct peaks at 254 nm, 366 nm and 620 nm, indicating the presence of multiple detectable constituents in the analysed fraction. The corresponding densitometric profiles and peak characteristics are presented in Figures 2a–2c.

Figure 2a.Densitometric scan of Trisugandha Arka at 254 nm

Figure 2. Densitometric scan of Trisugandha arka

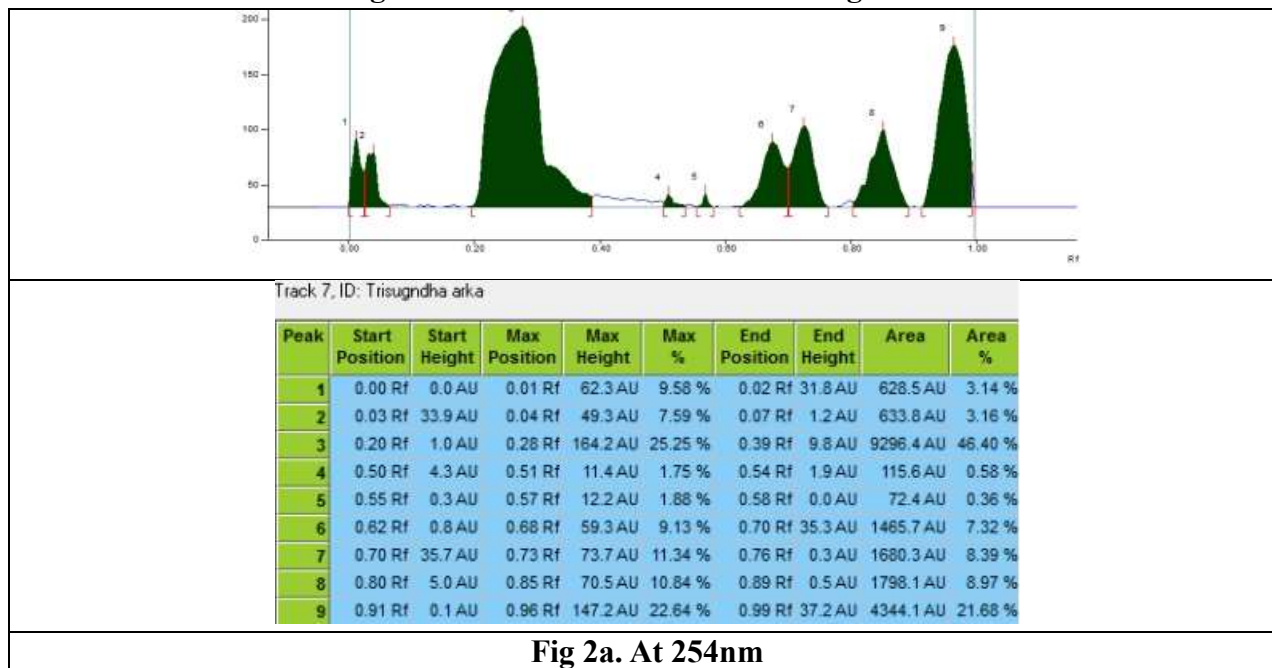


Fig 2a. At 254nm

Figure 2a. Densitometric scan of Trisugandha Arka at 366 nm

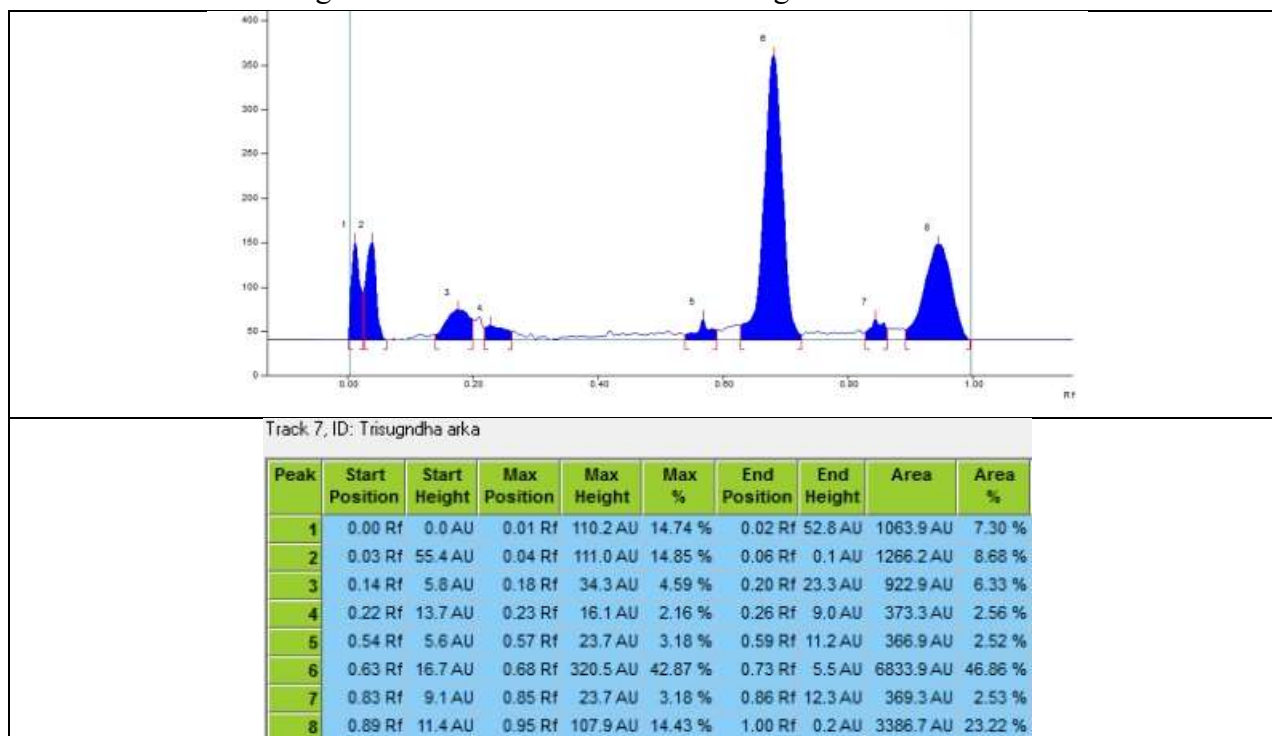
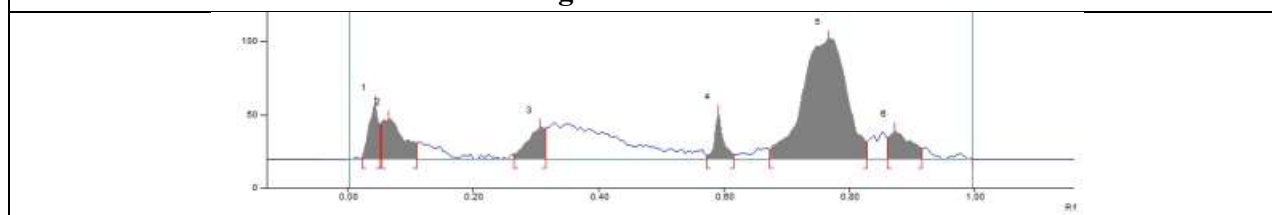


Fig 2b. At 366nm



Track 7, ID: Trisugandha arka									
Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.02 Rf	1.2 AU	0.04 Rf	37.2 AU	17.01 %	0.05 Rf	23.8 AU	411.2 AU	6.34 %
2	0.05 Rf	24.2 AU	0.07 Rf	27.3 AU	12.52 %	0.11 Rf	11.2 AU	700.5 AU	10.80 %
3	0.27 Rf	3.5 AU	0.31 Rf	21.7 AU	9.95 %	0.32 Rf	20.9 AU	436.6 AU	6.73 %
4	0.57 Rf	2.8 AU	0.59 Rf	31.2 AU	14.27 %	0.62 Rf	2.9 AU	307.6 AU	4.74 %
5	0.67 Rf	6.8 AU	0.77 Rf	81.9 AU	37.48 %	0.83 Rf	11.7 AU	4150.4 AU	63.99 %
6	0.86 Rf	14.7 AU	0.87 Rf	19.2 AU	8.77 %	0.92 Rf	7.3 AU	480.1 AU	7.40 %

Fig 2c. At 620nm

Figure 2c. Densitometric scan of Trisugandha Arka at 620 nm

DISCUSSION:

The present analytical evaluation was undertaken to establish preliminary quality-control and standardization parameters for Trisugandha Arka, a classical Ayurvedic preparation indicated for oral use. The formulation was evaluated for organoleptic characteristics, physicochemical parameters and HPTLC fingerprinting to provide reproducible analytical characteristics of the prepared sample.

The organoleptic evaluation showed Trisugandha Arka to be colourless with characteristic odour and free from visible particles and growth, indicating a clear and uniform distillate. The physicochemical analysis showed a specific gravity of 0.9641, refractive index of 1.33206, pH of 6.0, viscosity of 1.0456 and total acidity of 0.18, along with a volatile matter content of 0.23%. These parameters provide important baseline characteristics for identification and quality assessment of the formulation.

The HPTLC profile of the n-hexane fraction demonstrated distinct chromatographic bands with characteristic Rf values under different visualization conditions. The observed bands at Rf 0.21, 0.66 and 0.88 under short UV, together with the corresponding fluorescence and post-derivatization profile, provide a characteristic chromatographic fingerprint of the analysed Trisugandha Arka sample. Such fingerprinting may serve as a useful tool for identity and batch-to-batch quality assessment of the formulation.

The selection of Trisugandha Arka in the present study is supported by its classical reference in Arka Prakasha, Chaturtha Shatakam, 5th Śloka. The formulation is described as being prepared from Tvak, Ela and Patra in equal proportions, collectively referred to as Trisugandha. The classical text describes its action as Mukha Daurgandhya Chedana and Mala Bhedana, indicating its utility in removing oral malodour and accumulated oral impurities.

त्वगेलापत्रकैस्तुल्यैस्त्रिसुगन्धमिति स्मृतम् ।

तदर्कं मुखदौर्गन्ध्यच्छेदनो मलभेदनः ॥५॥

The Mala Bhedana property described for Trisugandha Arka provides a rational basis for its consideration in conditions associated with accumulation of deposits within the oral cavity. In the present study, the accumulated dental plaque was considered in relation to the concept of Danta Mala/Dantaśarkara, while Danta Nirlekhana (dental scaling) was employed for mechanical removal of the existing deposits. Following scaling, Trisugandha Arka was used as a mouth rinse to support oral hygiene and help reduce the possibility of re-accumulation.

The three constituent drugs, Tvak, Ela and Patra, are aromatic drugs traditionally used in oral care. Their incorporation into an Arka formulation provides a liquid preparation suitable for local administration within the oral cavity. Thus, the classical description of Trisugandha Arka, particularly its Mukha Daurgandhya Chedana and Mala Bhedana actions, provides the textual rationale for its selection as an adjunctive mouth rinse following Danta Nirlekhana in the present study.

Significance of Analytical Parameters

The physicochemical parameters evaluated in the present study provide preliminary quality-control characteristics of Trisugandha Arka. Specific gravity reflects the relative density of the distillate and can serve as a useful parameter for assessing consistency of the preparation. Viscosity indicates the flow characteristics of the formulation and is relevant to its uniform distribution during oral administration. The pH of 6.0 provides a measure of the acidic or alkaline nature of the preparation and is an important consideration for a formulation intended for repeated contact with the oral cavity. Total acidity provides an additional physicochemical characteristic of the formulation, while the volatile matter content reflects the volatile fraction present in the Arka.

The HPTLC fingerprint further provides a characteristic chromatographic profile of Trisugandha Arka. The presence of reproducible bands at characteristic R_f values under different visualization conditions can be useful for establishing the identity and consistency of the formulation. Collectively, these parameters provide a preliminary analytical profile that may serve as a reference for quality control and standardization of Trisugandha Arka.

Conclusion

The present analytical evaluation established characteristic organoleptic, physicochemical and HPTLC parameters for Trisugandha Arka. The findings provide preliminary standardization data for the formulation and may serve as reference parameters for its quality assessment. The classical description of Trisugandha Arka as Mukha Daurgandhya Chedana and Mala Bhedana provides the textual basis for its selection as an adjunctive oral formulation following Danta Nirlekhana in the management of Dantaśarkara.