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Preparation and GC-MS Analysis of *Gudoochi (Tinospora Cordifolia Willd) Arka*.

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ABSTRACT

Introduction: *Arka Kalpana* is one among the extraction methods in Ayurveda, where volatile bioactive compounds of a drug are extracted using hydro-distillation process. The authentic references of *Arka Kalpana* are available in the classical text book *Arka Prakasha*. The book *Ayurveda sara sangraha* is another reliable source which provides guidelines regarding the general method of preparation of *Arka*. Various *Arka* formulations, its dose and indications have been described in *Ayurveda Sara Sangraha*. *Arka* as a dosage form is potent, palatable, received by patients, with a comparative long shelf life without adding any preservatives.

Method: The present work deals with the preparation and GC-MS analysis of *Gudoochi Arka*.

Result: GC-MS studies had revealed that the bioactive compound detected in *Gudoochi Arka* in the decreasing order of their abundance is *1-Docosene, 1-Nonadecene, E-15-Heptadecenal, Phenol, 2, 4-bis (1, 1-dimethylethyl)-, 1-Eicosanol, Trichloroacetic acid, pentadecyl ester, 10-Heneicosene (c,t), Heptadecane, 9-hexyl*.

Conclusion: Analysing the properties of these bioactive compounds, it was understood that they exhibit clinical activities like anti-inflammatory, antioxidant, antimicrobial, anticancer, antifungal, Hypocholesterolemic activities which ensures that this formulation can be used for a wide range of ailments.

Keywords: *Arka Kalpana, Arka Prakasha, Ayurveda Sara Sangraha, Gudoochi Arka, GC-MS.*

INTRODUCTION

Arka Kalpana is a liquid dosage form, described in Ayurvedic pharmaceutics. The method is similar to the simple distillation process in modern science. Even though this dosage form is not included among the general '*Panchvidha Kashaya Kalpana*',¹ it has a significant role in clinical practice because of its palatability, better patient compliance, increase potency, minor dose, and better bioavailability, compared to other medicinal forms. The chief reference book for *Arka Kalpana* is '*Arka Prakasha*,' which is considered to be authored by *Lankapati Ravana*. The book is presented as a conversation between *Ravana* and *Mandodari*.²[*Arka Prakasha, Chapter 1, Sloka 3-8, p.1-2*] This book describes in detail about the preparation of apparatus for extracting *Arka*. The apparatus is known as *Arka yantra*. *Arka Prakasha* describes various proportions of water as medium of extraction in the preparation of *Arka* based on

the factors *like* hardness of the drug which may be hard or soft, part of drug varying from leaves to seeds, water content in the drug.²[*Arka Prakasha, Chapter 2, Sloka 2-31, p.20-22*] The book *Rasatarangini* of *Acharya Sadananda Sarma* describes '*Naadika yantra*',³ to extract '*Parisruta Jala*'.⁴ In fact '*Parisruta Jala*' is *Arka* and '*Naadika Yantra*' is *Arka Yantra* itself.

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Apart from this classical work, latest books like *Ayurveda Sara Sangraha* gives improved guidelines for the preparation of *Arka Yantra* implementing modern aids in the extraction of *Arka*.⁵ [*Ayurveda Sara Sangraha*, p.639] This book also describes a number of *Arka* preparations, its dosage and indications.⁵ [*Ayurveda Sara Sangraha*, p.641-649] The reference of *Gudoochi Arka* is available in *Arka Prakasha* in the treatment perspective of *Kaamala*.² [*Arka Prakasha*, Chapter 5, Sloka 28, p.77] (which may be correlated to Hepatic disease). *Gudoochi Arka* is also indicated in the treatment of *Vatarakta*.⁹ [*Arka Prakasha*, Chapter 5, Sloka 88, p.1-2] (which may be correlated to diseases of inflammatory basis, autoimmune diseases). In *Ayurveda Sara Sangraha*, there is a detailed method of preparing *Gudoochi Arka*. In this book *Gudoochi Arka* is indicated in a number of diseases like *Amavata*, *Vatarakta*, *Prameha*, *Raktapitta*, *Jirna jwara*, *Madhumeha*.³ [*Ayurveda Sara Sangraha*, p.641] These ailments may be correlated to diseases of Rheumatism, Pre-diabetic, bleeding diseases, metabolic syndromes, diabetic diseases respectively.

METHOD

Fresh *Gudoochi* stems, collected on 24/01/2019 from Thiruvananthapuram district, which were identified as *Tinospora cordifolia Willd* by microscopical evaluation in the *Dravyaguna* department of our college were used for the study. *Arka* was prepared from this specimen according to the guidelines in *Ayurveda Sara Sangraha* by using simple distillation apparatus.

Method of preparation

For distilling 150 gram fresh *Gudoochi* stems, 1500 ml water was required making a ratio of drug to water: 1: 10. Fresh *Gudoochi* stems were initially cut into smaller pieces of average length 10 cm. The outer skin which is generally brownish- green in colour was peeled off. The stems were cleaned in water and sliced well. After proper slicing, these were transferred into a vessel 500 ml of water. The mouth of the vessel was closed and kept undisturbed for overnight.⁵ [*Ayurveda Sara Sangraha*, p.639] On the next day, the water was decanted and collected in the distillation flask. The *Gudoochi* slices were then transferred slowly into the distillation flask. The remaining 1000 ml water was added to it. The apparatus was set in the proper manner and heated in a gas stove under medium fire. ⁵ [*Ayurveda Sara Sangraha*, p.640] The process was carried out, till 2/3 part volume of

Arka with respect to soaked water, ⁵ [*Ayurveda Sara Sangraha*, p.639] was collected in the receiver.

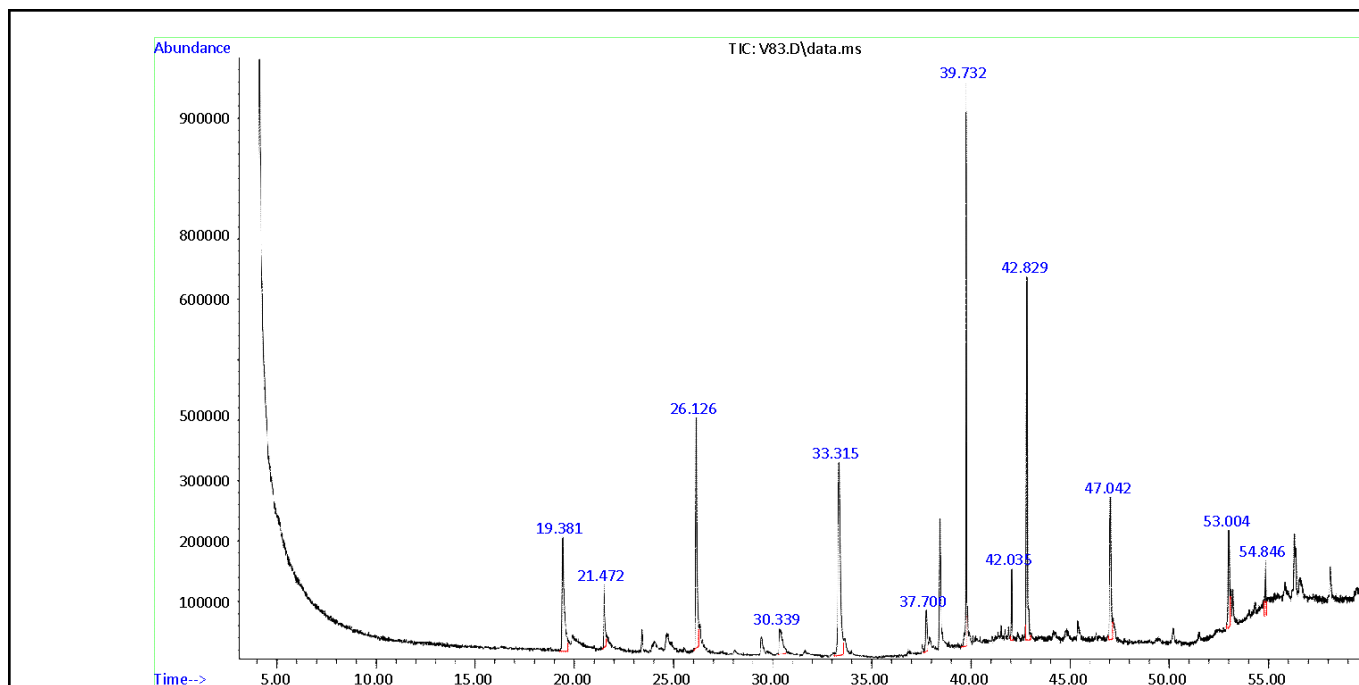
Gcms – Profiling Method

10ml sample extracted with dichloromethane (HPLC Grade) collects a DCM layer evaporated at room temperature and residue reconstituted with 1ml DCM and injected to GCMS. Instrument Model: 7890 A GC with 5975C with triple axis detector. Column: DB 5MS 30 m x 0.250mm Diameter x 0.25 Micrometer Thickness. Initial temperature: 40 °C, Hold Time: 5 min, Rate: 5 °C/min, Final Temperature: 280 °C, Injection Volume: 3 µL, Injector Temp: 280 °C, Pressure: 7.0699 psi, Flow: 1mL/min, Carrier Gas: Helium, Ionization Temperature: 80eV, Injection Mode: Split, Library: NIST08 Spectral Data.

RESULTS

GC-MS analysis results:

Gudoochi Arka are colourless and tasteless liquid preparations with characteristic odour. GC-MS studies had revealed certain bioactive compounds in *Gudoochi Arka*. In the decreasing order of their abundance these compounds are *1-Docosene*, *1-Nonadecene*, *E-15-Heptadecenal*, *Phenol*, *2,4-bis(1,1-dimethylethyl)-1-Eicosanol*, *Trichloroacetic acid*, *pentadecyl ester*, *10-Heneicosene (c,t)*, *Heptadecane*, *9-hexyl-9-Octadecenoic acid (Z)-, methyl ester*, *S-Indacene*, *1,2,3,5,6,7-hexahydro-1,1,5,5-tetramethyl-4,8-bis(3-methylbutyl)-1-Docosene* were available in two peaks with a retention time of 39.732 and 42.829 min creating a percentage occupancy of 19.150 and 14.175. Similarly, two peaks were available for *1-Nonadecene* with a retention time of 30.339 and 33.315 min and percentage occupancy 3.074 and 18.429. The retention time of *E-15-Heptadecenal* was 26.126 min with percentage occupancy 11.525. *Phenol*, *2, 4-bis (1, 1-dimethylethyl) -* had a retention time of 19.381 min and a residence of 9.472 percent. The retention time of *1-Eicosanol* was 47.042 min and the percentage occupancy was 8.423. The retention time of *Trichloroacetic acid, pentadecyl ester* was 53.004 min and the percentage occupancy was 4.690. *10-Heneicosene (c,t)* had a retention time of 21.472 min and an occupancy of 3.537 percent. The compound *Heptadecane, 9-hexyl-*, had a retention time of 54.846 min and percentage occupancy of 2.804. *9-Octadecenoic acid (Z)-, methyl ester* had a retention time of 37.700 min and percentage occupancy of 2.510. *S-Indacene, 1,2,3,5,6,7-hexahydro-1,1,5,5-tetramethyl-4,8-bis(3-methylbutyl)-* had a retention time of 42.035 min and percentage occupancy of 2.211. (Table 1)

Figure 1. GC-MS chromatogram of *Gudoochi* Arka.Table 1. Volatile compounds present in the *Gudoochi* Arka.

Peak	R.T.min	Name of the compounds	% of total
1	19.381	Phenol, 2,4-bis(1,1-dimethylethyl)-	9.472%
2	21.472	10-Heneicosene (c.t)	3.537%
3	26.126	E-15-Heptadecenal	11.525%
4	30.339	1-Nonadecene	3.074%
5	33.315	1-Nonadecene	18.429%
6	37.700	9-Octadecenoic acid (Z)-, methyl ester	2.510%
7	39.732	1-Docosene	19.150%
8	42.035	S-Indacene, 1,2,3,5,6,7-hexahydro-1,1,5,5-tetramethyl-4,8-bis(3-methylbutyl)-	2.211%
9	42.829	1-Docosene	14.175%
10	47.042	1-Eicosanol	8.423%
11	53.004	Trichloroacetic acid, pentadecyl ester	4.690%
12	54.846	Heptadecane, 9-hexyl-	2.804%

Table 2. Chemical Identity of compounds in *Gudoochi* Arka revealed by GC-MS.

Compound	Chemical name	Molecular weight in g/mol
Phenol, 2,4-bis(1,1-dimethylethyl)- (PD)	C ₁₇ H ₃₀ O	278.5
E-15-Heptadecenal	C ₁₇ H ₃₂ O	252.4354
1-Nonadecene	C ₁₉ H ₃₈	266.5
9-Octadecenoic acid (Z)-, methyl ester	C ₁₉ H ₃₆ O ₂	296.4879
1-Docosene	C ₂₂ H ₄₄	308.5848
S-Indacene, 1,2,3,5,6,7-hexahydro-1,1,5,5-tetramethyl-4,8-bis(3-methylbutyl)	C ₂₆ H ₄₂	354.6
1-Eicosanol	C ₂₀ H ₄₂ O	298.5469
Trichloroacetic acid, pentadecyl ester	C ₁₇ H ₃₁ Cl ₃ O ₂	373.786
Heptadecane, 9-hexyl-	C ₂₃ H ₄₈	324.6272

DISCUSSION

The chemical compounds detected in *Gudoochi Arka* retain definite therapeutic effects which were established by previous research works. *Phenol*, *2,4-bis(1,1-dimethylethyl)- (PD)* holds antibacterial, antioxidant, anti-malarial activities.⁶ *PD* also retain antifungal, anti-inflammatory, anticancerous activities.⁷ *E-15-Heptadecenal* is Fatty acid amide hydrolase.⁸ *1-Nonadecene* possess, anti-bacterial, anti-tumor, antimicrobial activity.⁹ *9-Octadecenoic acid (Z)-, methyl ester* possess properties of anti-inflammatory, anti-androgenic, cancer preventive, dermatitogenic, hypocholesterlemic, 5- alpha reductase inhibitor, anemiagenic, insectifuge.¹⁰ *1-Docosene* retains anti-bacterial activity.¹¹ *1-Eicosanol* possess anti-bacterial activity.¹² *Heptadecane, 9-hexyl-* possess anti-fungal activity.¹³ After evaluating the diseases where *Gudoochi Arka* is indicated, it may be anticipated that this formulation has a significant role in diseases where the *Dathu* like *Rasa, Rakta, Mamsa, Meda, Asthi* are vitiated. As per the indications, it possess the *Karmas* like *Ama Pachana, Medohara, Raktasodhana, Sophahara,* and *Vedanahara*. The pharmacological activities of above mentioned bio active compounds detected through GC-MS which include anti-inflammatory, hypocholesteremic, antioxidant, anti tumor, cancer preventive, antimicrobial, strongly supports that the our *Acharyas* had extensive knowledge in identifying the properties of each drug through their *Rasaadi Panchakas* .

Through the fundamentals principles of *Rasa –Guna-Viryā –Vipaka* and *Prabhava*, the pharmacological action of a drug or their formulations can be explained. This also gives us a guideline to either opt for a drug or formulation which is described in the classics or to frame a new formulation for a particular disease.

The dose of *Gudoochi Arka* is 2-5 *Tola*,⁵ [Ayurveda Sara Sangraha, p.641] (which in metric equivalents occupies 24 ml – 60 ml). It is administered with or without dilution. The diluting media is water which is generally added in equal quantity. The dose may be fixed based on the factors like *Roga Bala* (Strength of the disease), *Rogi Bala* (Strength of the patient), *Desa* (Place), *Kala* (Season), *Vaya* (Age of the patient) etc.

Limitations of the study

The analysis of *Gudoochi Arka* alone, which is the final product, has been done. Neither the raw drug, nor its derivatives has been analytically compared.

Recommendations

Further research works to prove the clinical efficacy of this formulation with respect to different disease conditions are recommended.

CONCLUSION

The liquid dosage form prepared by distilling the stems of *Gudoochi* (*Tinospora cordifolia Willd*) with water can be opted as an effective constituent for certain treatment approaches. *Gudoochi Arka* on GC-MS analysis has revealed certain bioactive compounds which ensures that the formulation has clinical activities like anti-inflammatory, antioxidant, antimicrobial, anti-cancer, anti-fungal, hypocholesteremic, anti-tumor. This endorses that the formulation may exhibit an effective therapeutic effect of diseases of metabolic dysfunction, inflammatory diseases, microbial diseases etc.

REFERENCES

1. Agnivesha, Charaka Samhitha, Chakrapani Datta, Ayurveda Deepika Vyakhyana, Sutrasthana, Chaukhamba Surbharati Prakashan, Rp 2009 ,Chapter 4 , p. 31 , Sloka 7.
2. Lankapathi Ravana, Dr.Indradev Tripathi. Arka Prakasha. (4thed)Varanasi: Chowkambha Krishnadas Academy. 2015. Chapter 1 pg. 1-2. Sloka 3-8.
3. Sri Sadanantha, Sarma, Sri Haridatta, Sastri, Pandit, Sastri. Rasatarangini. (11 ed.). New Delhi: Motilal Banarasi das; 2014.chapter 4 Pg 57-58, sloka 42-46
4. Sri Sadanantha, Sarma, Sri Haridatta, Sastri, Pandit, Sastri. Rasatarangiini. (11 ed.). New Delhi: Motilal Banarasi das; 2014.chapter 4 Pg 57-58, sloka 42-46.
5. Ayurveda Sara Sangraha, Alahabhad, Sri Baidhyanath Ayurveda Bhavan Ltd, 2018 Pg. 641-649.
6. Selvaraj, C. ImmanuelRavi, Lokesh,Ruthiran, Papitha , Phytochemical Screening, FT-IR and Gas Chromatography Mass Spectrometry Analysis of *Tinospora cordifolia* (Thunb.) Miers International Journal of Pharmacognosy and Phytochemical Research, VL - 8,PY - 2016/12/04 SP - 2020 EP - 2024.
7. Wagay N.A., Yatoo Ghulam Mohiuddin, Khan N.A., Phytochemical evaluation and identification of

- bioactive compounds in camel thorn alhagi pseudalhagi (M. BIEB.) DESV. EX B. KELLER & SHAP. STEM, International Journal of Advance Research in Science and Engineering, VL-07, SI-No: 04, March 2018
8. Devakumar J, Keerthana V, Sudha S S, Identification of Bioactive Compounds by Gas Chromatography-Mass Spectrometry Analysis of *Syzygium Jambos (L.)* Collected From Western Ghats Region Coimbatore, Tamil Nadu, Vol 10, Issue 1, 2017, Online - 2455-3891 Print - 0974-2441.
 9. P Vani et al. Phytochemical investigation, antibacterial activity and antioxidant activity of the endangered *Commiphora wightii (Arn.) Bhandari*, Journal of Pharmacognosy and Phytochemistry ; 2016 JPP 2016; 5(5): 22.
 10. Krishnamoorthy K, Subramaniam P. Phytochemical Profiling of Leaf, Stem, and Tuber Parts of *Solena amplexicaulis (Lam.) Gandhi* Using GC-MS. Int Sch Res Notices. 2014; 2014:567409. Published 2014 Jul 14. doi:10.1155/2014/567409.
 11. Elsayed, Tarek, Galil, Diana, Sedik, Mohammed, Hassan, Hazem, Sadik, Mahmoud ,PY-2020/09/11, Antimicrobial and Anticancer Activities of Actinomycetes Isolated from Egyptian Soils, International Journal of Current Microbiology and Applied Sciences, VL - 9, DO -10.20546/ijcmas.2020.909.209 .
 12. Chatterjee, Soumendranath, Karmakar, Amarnath Azmi, Syed Barik, Anandamay Antibacterial Activity of Long-Chain Primary Alcohols from *Solena amplexicaulis* Leaves, DO - 10.1007/s12595-017-0208-0, PY - 2017/02/13.
 13. Mayuri Chelkar, Mahesh Harke and Arul Pandiyan Identification of chemical compounds from the ethanolic extract of *Bauhinia racemosa Lam.* Bark by GC-MS analysis The Pharma Innovation Journal 2020; 9(11): 11-13.

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