

**PREPARATION AND CHARACTERIZATION OF NAGARJUNA VARTI: A
HERBOMINERAL FORMULATION OF AYURVEDA*****¹Dr. Vikram S., ²Dr. Sangeeta Rao, ³Dr. Ravindra Angadi and ⁴Dr. Suresh Janadri**¹Professor, H.O.D, Department of Rasashastra and Bhaishajyakalpana, Sri Sri College of Ayurvedic Science and Research, Bengaluru, Karnataka.²Associate Professor, Department of Rasashastra and Bhaishajyakalpana, Sri Sri College of Ayurvedic Science and Research, Bengaluru, Karnataka.³Professor, H.O.D, Department of PhD and PG studies in Rasashastra and Bhaishajyakalpana, SDM College of Ayurveda Udupi, Karnataka.⁴Associate Professor & Research co-ordinator, Department of Pharmacology, Acharya & BM Reddy College of Pharmacy, Bangalore, Karnataka.***Corresponding Author: Dr. Vikram S.**

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ABSTRACT

Use of Herbomineral preparation in healthcare is a unique contribution of Ayurveda, such preparations are called *Rasoushadhis*. Nagarjuna Varti is one among such preparations which consist of Chakshushya drugs like Rasanjana, Prapoundarika, Yashtimadhu, Lodhra, Tamra Bhasma etc which can play a vital role in various biochemical events in the body as well as eyes. They act as catalyst, co-factor for enzyme etc. These complexes help in exerting faster action of the drug and have a longer shelf life. It benefits even in Netra Chikitsa in different folds. In Ayurveda, visual disturbances are described in the context of Timira, Kacha and Linganasha. Ancient scholars have advocated different Varti/Anjana application in Timira stage itself. One such significant ocular therapeutic formulation is Nagarjuna Varti. It is important to study the constitution of the drug before testing its clinical efficacy. In this article characterisation of nagarjuna varti, and probable correlation with its therapeutic utility is attempted.

KEYWORDS: Varti, Nagarjunavarti, Timira, Characterization.**INTRODUCTION**

In the field of Ayurveda, Oushadhi is considered as one of the thrisootra, which is the essential part in the treatment of any disease. Herbomineral preparation which contains ingredients from plant and animal source are one kind of oushadhi, used in Ayurveda. Nagarjunavarti is one such herbomineral preparation,

which includes both herbal and mineral drugs and indicated in timira. It is important to study the constitution of the drug before testing its clinical efficacy.^[1] The article aims to study the composition and structure of nagarjunavarti, using various physico chemical and instrumental analyses.

MATERIALS AND METHODS**Ingredients of nagarjuna varti.^[1]**

Sl no.	Ingredients	Scientific name	Quantity
1	Hareetaki	Terminalia chebula	1 PART
2	Vibheetaki.	Terminalia bellerica	1 PART
3	Amalaki	Embilica officinalis	1 PART
4	Saindhalavana	Rock salt	1 PART
5	Shunti	Zingiber officinale	1 PART
6	Mareecha	Piper nigrum	1 PART
7	Pippali	Piper longum	1 PART
8	Yashtimadhu	Glycyrrhiza glabra	1 PART
9	Sudhatuttha	Purified blue vitriol	1 PART
10	Rasanjana	Extract of Berberis aristata	1 PART
11	Prapoundareeka	Cassia absus	1 PART

12	Vidanga	Embelia ribes	1 PART
13	Lodhra	Symploco racemosa	1 PART
14	Tamra bhasma	Incinerated copper (CuO)	1 PART
15	Nabhojala	Rain water	QS

Method of Preparation

After powdering the drugs, vastragalita sookshma choorna are taken in a clean porcelain khalwayantra in the quantity of 35 grams each. In porcelain khalwa, the loss of drug was very minimal. The drugs are put into khalwayantra one after the other in the respective order and after adding each dravya, the mixing is carried out through mardana to ensure the proper mixing of all the powder.^[1]

Nabhojala is collected in hygienic conditions, and into the khalwayantra, the collected nabhojala is added little by little to assure there is no lump forming in the preparing kalka. Continuous bhavana is carried out with nabhojala to get a finer consistency to the kalka. The kalka is tested for perfectness like, after making the varti, there are no cracks formed in it. Once the kalka is prepared, 0.5 g of kalka is taken and rolled into a varti shape and it is kept in a clean and dry stainless steel pan. The pan containing varti is kept under shade by covering it with a clean and dry gauze piece over it. It took three days for the varti to get dry completely. Later on the varti is weighed and kept in zip lock plastic cover.

RESULTS

Pharmaceutical study

Total weight of the prepared varti after shade drying: 430 g. Loss : 20 gm.

Methodology of instrumental analysis

SEM-EDX analysis^[3]

Procedure: EVO MA 15 Carl-Zeiss, Germany model was used for SEM-EDX analysis. Electron beam excitation is used in electron-microscopes, scanning electron microscopes (SEM) and scanning transmission electron microscopes (STEM). A detector is used to convert X-ray energy into voltage signals; this information is sent to a pulse processor, which measures the signals and passes them on to an analyser for data display and analysis. The most common detector now is Si (Li) detector cooled to cryogenic temperatures with liquid nitrogen; however newer systems are often equipped with silicon drift detectors (SDD) with Peltier cooling systems. The detector used in EDX is often the Lithium drifted Silicon detector. This detector must be operated at liquid nitrogen temperatures. When an X-ray strikes the

detector, it will generate a photoelectron within the body of the Si. As this photoelectron travels through the Si, it generates electron-hole pairs. The electrons and holes are attracted to opposite ends of the detector with the aid of a strong electric field. The size of the current pulse thus generated depends on the number of electron-hole pairs created, which in turn depends on the energy of the incoming X-ray. Thus, an X-ray spectrum can be acquired giving information on the elemental composition of the material under examination.

XRD analysis^[4]

Procedure: powder the sample approximately upto 200 mesh size, and load the sample in a sample holder provided with the machine. Switch ON the X pert pro machine and select the X pert pro data collector programme followed by increasing the current and voltage to the X- ray tube to the desired level and select throgramme. Name the folder and file of the sample for identification and start scanning as per the programme. Get out of X pert pro data collector programme and go to X pert pro high score programme selects the peaks and go to analysis and execute search match. Pick up the right mineral / compound based on scoring and matching of peaks.

FT-IR^[5]

Infra red energy is emitted from a glowing black body source. This beam passes through an aperture which controls the amount of energy presented to the sample. The beam enters the interferometer where the spectral encoding takes place. The beam enters the sample compartment where it is transmitted through or reflected off of the surface of the sample. The beam finally passes to the detector for final measurement. The measured signal is digitalized and sent to computer where Fourier transformation takes place. The final infrared spectrum is then interpreted.

DSC^[6]

This test consists of heating or cooling the sample at a controlled rate under a specified purge gas at a controlled flow rate and continuously monitoring with suitable sensing device the difference in heat input between a reference material and the sample due to energy changes in the material.

Organoleptic characterization.

Sl no	Organoleptic Characters of Nagarjunavarti	
1	Colour	Uniform colour of Brownish -Dark Greenish
2	Odour	Characteristic odour
3	Taste	-
4	Touch	Soft
5	Appearance	Cylindrical, Biconvex shape

Physico- chemical characterization.

Sl no	Pharmaceutical parameters	
1	Hardness	Nil
2	Uniformity of Weight distribution	In center part thick & tapering toward both ends
3	Physical description	Cylindrical, Biconvex and uniform colour

Sl No	Physical parameters	
1	Moisture Content	8.2%
2	Test for Total Ash	20.72%
3	Test for Acid-in-soluble ash	3.94 %
4	Test for Alcohol soluble extract	20.82%
5	Test for Water soluble extract	10.4 %

Microbial contamination.

Sl no	Microbial contamination	
1	Total Microbial plate count	< 10 cfu/g
2	Total yeast & mold	< 10 cfu/g

Sl no	Specific test for specific pathogen	
1	E.coli	Absent
2	Salmonella spp	Absent
3	Staphylococcus aureus	Absent
4	Shigellaspp	Absent
5	Pseudomonas aeruginosa	Absent

Test for heavy metals

Sl No	Test for heavy / toxic metals	
1	Lead	< 1
2	Cadmium	< 0.1
3	Mercury	22.8
4	Arsenic	< 1

Elemental characterization

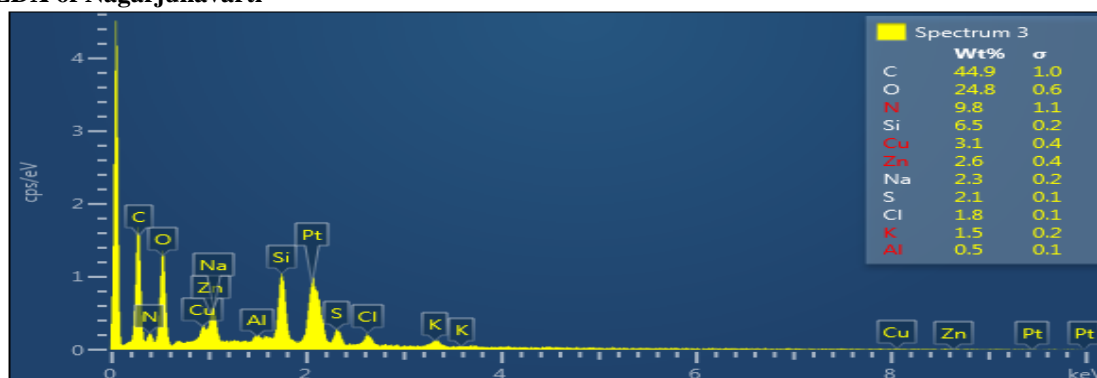
SEM EDX graph of Tamrabhasma

In SEM analysis of tamrabhasma shows the presence of copper, sulphur and oxygen in 56, 20, and 8 percentages respectively.

ICP-MS examination of nagarjunavarti.

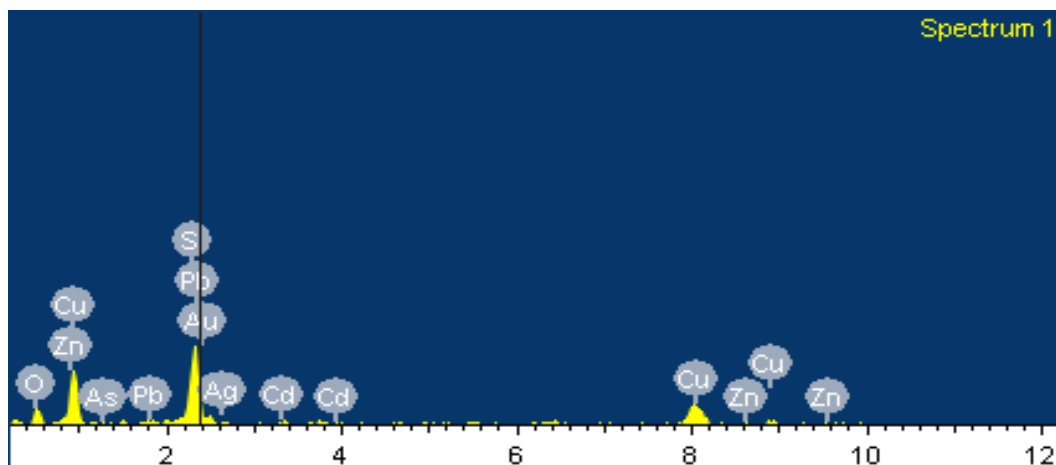
Sl. No	Sample Identification	Copper(Cu) mg/Kg	Zinc(Zn) mg/Kg	Iron(Fe) mg/Kg	Manganese (Mn)mg/Kg
1	NagarjunaVarti	80810.0	165.5	5745.0	391.2

In the ICP MS analysis of Nagarjunavarti, the elements detected are, copper, zinc, iron, and manganese.

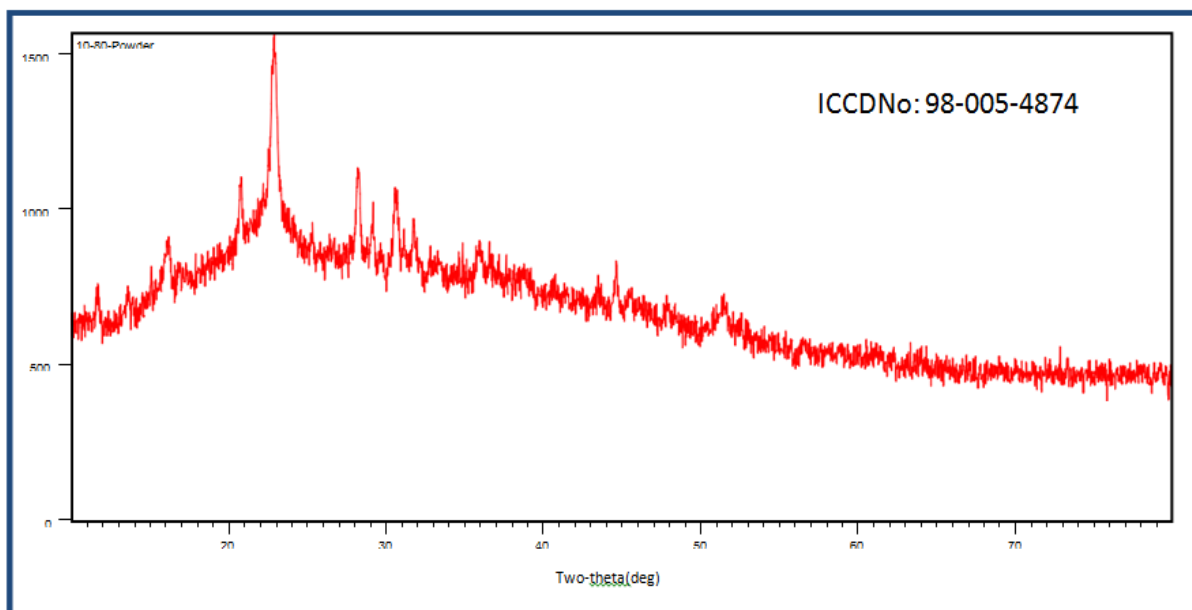
SEM- EDX of Nagarjunavarti

In the SEM EDX analysis of Nagarjunavarti there were 11 elements detected as carbon, nitrogen, oxygen,

sodium, Aluminium, silica, sodium, chlorine, potassium, copper, and zinc.



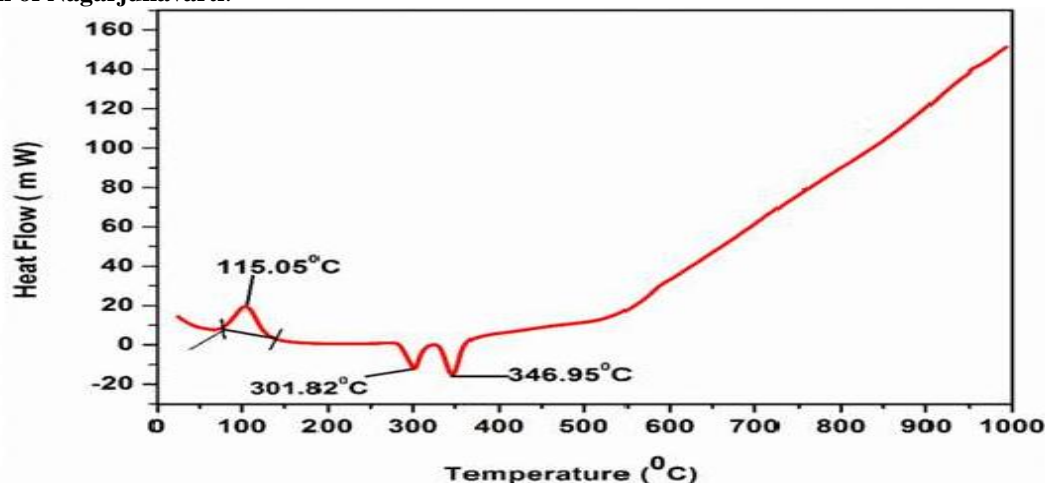
XRD result



The tested sample predominantly contains, copper oxalate tetra hydrate having crystallinity.

FTIR Results.

Absorption peaks		A	B	C	D	E	F	G	H	I
Wave number (1/cm)	3645-3600	2920	2850	1745	1406 & 873	1150 & 1130	1055 – 1020	685-710	675	610-590
Functional Group Details	Non bonded hydroxyl group, OH stretch	Methylene C-H asym./sym. Stretch	Methoxy methyl ether	Alkyl carbonate	Secondary amine	Secondary amine	Organic silicone	Thiol	C-H stretch	Alcohol, OH out of plane bend.

DSC graph of Nagarjunavarti.**DISCUSSION**

The bhavana ensures the particle size reduction of ingredients into micro size. The final product showed sidhilakshana of varti, like uniformity of color and texture. The presence of herbal drugs in the formulation yields a higher percentage of total ash. There is no microbial growth noticed for tested microbes, assuring the aseptic condition of the varti, which is very important in ophthalmic preparations.

ICP MS analysis detected the presence of copper, Zinc, Iron and Manganese which were under the limits. The major element detected is copper, is added up, from one of the ingredients i.e. tamrabhasma. Even iron was detected in more quantity, rest of the elements might be added up from the other ingredients of the Nagarjunavarti.

SEM EDX analysis reveals the presence of carbon, nitrogen, oxygen, sodium, aluminium, silica, sulphur, chlorine, potassium, copper and zinc. Whereas in tamrabhasma, the presence of copper, oxygen and sulphur was only detected. In XRD analysis, it has been found that, the sample contains copper in the form of oxalates. Where as in FTIR study, different functional groups are detected in the tested sample of Nagarjunavarti.

Tamra, and tuttha, the ingredients in the formulation, along with other metals detected in characterisation of the formulation may help in the prevention of thickening of the lens in the eye and may help in preventing the occurrence of cataract. Copper is proven to improve the blood circulation in the body, even by helping the neovascularisation, it helps to prevent the inflammation, and helps in total improvisation of the vision.^[2]

The other herbal drugs present in the formulation are explained for their effect in restoring and improving the functional aspects of netra. Thus the formulation serves both the function of prevention of timira and its regression in its initial stages. The other herbal drugs present in the formulation are explained for their effect in

restoring and improving the functional aspects of netra. Thus the formulation serves both the function of prevention of timira and its regression in its initial stages.

CONCLUSION

Through the characterization of nagarjunavarti, it is evident that the composition observed might help in the treatment oftimira by their Chakshusya and Lekhaneeya actions. This can be validated by further clinical or animal experimentation.

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