INNOVARE JOURNAL OF AYURVEDIC SCIENCES

Vol 7, Issue 1, 2019

ISSN- 2321-6832

Research Article

FOURIER-TRANSFORM INFRARED SPECTROSCOPY FOURIER INVESTIGATION OF 20 AND 30 PUTI NAGA BHASMA AN AYURVEDIC ALCHEMY AND ITS UTILITY

SINGH AZAD, DESALE VARUN*, SHUKLA JV

Department of Pharmaceutical Laboratory of Chemistry, Institute for Postgraduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar, Gujarat, India. Email: azadaswal@gmail.com

Received: 8 December 2018, Revised and Accepted: 12 February 2019

ABSTRACT

Objective: This study aim to analyze the 20 and 30 puti of Naga bhasma by Fourier transform infrared (FTIR) technique**.**

Materials and Methods: A 20 and 30 puti bhasma prepared in the laboratory of the Institute for Postgraduate Teaching and Research in Ayurveda and FTIR analytical parameter is done in IIT Bombay.

Results: Due to changes in herbal media, slight changes in the frequency in 20 puti and 30 puti.

Discussion: The 20 puti and 30 puti have different results due to herbal plants used in the processing.

Conclusion: FTIR is a sophisticated technique for the analysis of the Naga bhasma.

Keywords: Fourier transform infrared, Naga, Frequency, Analysis, Bhasma.

INTRODUCTION

Fourier-transform infrared (FTIR) spectroscopy is absorption in the infrared region of the spectrum by organic compound arises as a result of binding and stretching of covalent bonds at different characteristics frequencies. The frequency of vibration is related to both bond order and the mass of the atom attached to the bond, many organic compounds have a large number of relatively narrow absorption bands in midinfrared region (1600–900 cm^{-1}). These absorptions are highly specific and provide detailed structural information. Infrared spectra are particularly useful for the identification of the functional group and can usually distinguish between positional and conformational isomers. Except by comparison with an authentic spectrum, however, it is rarely possible to identify an unknown compound from infrared spectra [1-7]. *Sisaka* (Naga: Lead: Pb) is highly precious metal which is medicinal importance in Indian Alchemy. The synonyms are *Sisaka, Lisa, Nagaoka, and Pakuranga* used in classics literature. It is the first "Puti Loha." The symbol is Pb and atomic number 82 also known as heavy metal. Shiny chrome-silver luster obtained by lead when it is melted into a liquid media. Two types of Naga are, there one is grahyaswarupa and agrahyaswarupa in grahyaswarupa is heavy and smooth, it has a shiny inner surface, it is best for pharmaceutical and therapeutic purposes. Naga shodhana is done by two methods; in the first method, asuddha naga is melted and then pouring through "Pidhanaka yantra in fresh nirgundimula swarasa for 7 times, and in the second method, it is poured in "curnodaka" in 7 times. Moreover, then, Naga marana is taken place in which seven methods are prescribed in Rasa Tarangini. In this, Suddha manahsila is used and *Aloe vera* plant is used for marana. In this, the 20 puta and 30 puta are for bhasma preparation [8-26].

MATERIALS AND METHODS

Material

Naga/lead is collected from Institute for Postgraduate Teaching and Research in Ayurveda, Jamnagar, Gujarat (India). *Ghritkumari*, *Palash,* and *Vasa* collected from the campus of Jamnagar (Gujarat Ayurveda University).

METHODS

Shodhana, *Jarana,* and *Marana* of *Naga* will be carried out in the following steps.

Samanya shodhana of Naga

This process will be carried out as per the reference of

Sharangadhara Samhita 11/2 (AFI-I, Appendix-II, Page no.366).

Vishesha shodhana of Naga

This process will be carried out as per the reference Rasa Tarangini 19/10.

Marana of Naga (30 puta)

Marana process will be carried out as per the reference of Acharya Yadav Ji Rasa Kama Danu-514-517/Bhasma Vigyana, Page no. 329.

RESULTS AND DISCUSSION

FTIR spectrum of the sample is shown in Fig. 1. The spectrum of the sample shows large no of well-defined peaks in 400–2000 cm^{-1} (Table 1) region along with peaks in the higher frequency region. The broad peak at 2132.9 cm^{-1} is due to the $C{\equiv}C$ (terminal alkyne). Plant materials used in the preparation contains several organic molecules such as *Aloe vera* leaves contain phytochemicals under the study for possible bioactivities such as acetylated mannans, polymannans, anthraquinone C-glycosides, anthrones, and other anthraquinones such as emodin and various lectins contain turmeric powder which contains curcumin and curcuminoids. Vasa contains alkaloids, vasicine, adhatodinine, and several other types of molecules in traces. Palash contains beta-sitosterol, leucoanthocyanidin, amyrin, betulinic acid, and stigmasterol and enactive principal palasonin. All of these molecules give well-defined IR peaks due to them or their transform (due to heat treatment) in the fingerprint region (400–2000 cm^{-1}) (Table 2). These peaks are also present in the bhasma. Therefore, the prepared *bhasma* is associated with the organic macromolecules from herbs used in the preparation. These organic molecules certainly play an important role

Table 1: Naga bhasma 30 puti

S. No	Origin	Original frequency wavenumber (cm^{-1})	Group frequency wavenumber (cm^{-1})	Assignment
1	C≡C	2132.9	2140–2100	Terminal alkyne
2	C=C Stretch	1631.2	1680–1620	Alkenyl C=C stretch
3	C-H	1161.85	1190–1130	Secondary amine, CN stretch
4	C-Cl	796.74	800–700	Aliphatic chloro compounds
5	C-Cl	777.76	800–700	Aliphatic chloro compounds
6	C-H	676.34	680–610	Alkyne C-H bend
7	S-S	613.63	620–600	Disulfides (S-S stretch)
8	C-I	594.67	600–500	Aliphatic iodo compounds, C-I stretch
9	S-S	558.31	500–430	Aryl disulfides (S-S stretch)
10	S-S	483.31	500–470	Polysulfides (S-S stretch)

Table 2: Naga bhasma 20 puti

S. No	Origin	Original frequency wavenumber (cm^{-1})	Group frequency wavenumber (cm^{-1})	Assignment
1	O-H	3434.24	3570–3200 (broad)	Hydroxy group, H bonded OH stretch
2	C=C	1630.94	1680–1620	Alkenyl C=C stretch
3	C-N	1164.20	1190–1130	Secondary amine, CN stretch
4	C-Cl	796.89	800–700	Aliphatic chloro compounds, C-Cl stretch
5	C-Cl	777.78	800–700	Aliphatic chloro compounds, C-Cl stretch
6	C-H	677.11	680–610	Alkyne C-H bend
7	S-S	614.21	620–600	Disulfides (S-S stretch)
8	C-I	594.98	600–500	Aliphatic iodo compounds, C-I stretch
9	S-S	567.78	500–430	Aryl disulfides (S-S stretch)
10	S-S	483.44	500–470	Polysulfides (S-S stretch)

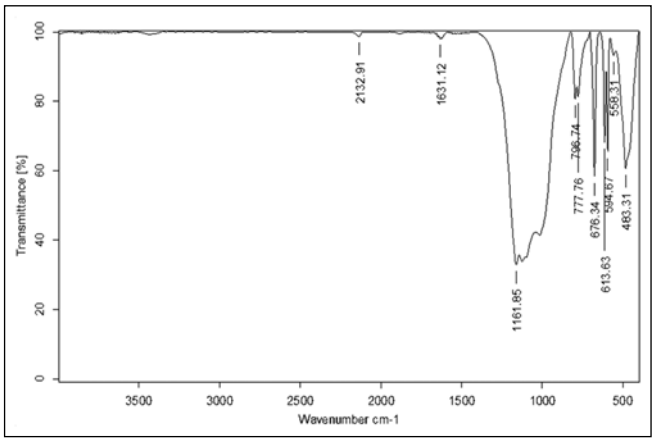

Fig. 1: Fourier transform infrared peak pattern Naga bhasma 20 puti

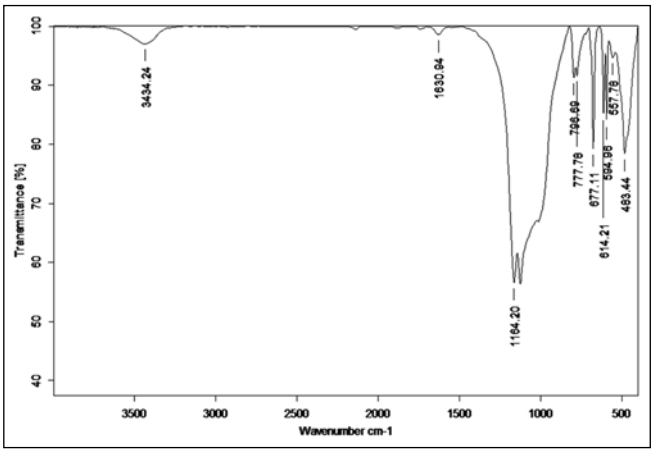

Fig. 2: Fourier transform infrared peak pattern Naga bhasma 30 puti

to increase the efficiency of *bhasma*. Attempt to find out their activity will certainly improve the understanding of bhasma.

CONCLUSION

Preparation procedure of the *bhasma* is very elaborate. The starting steps are basically to quench the melted lead into a different environment (due to different herbal juice) to interact the metal with the organic parts of the herbs. Further, grinding and heating of the material several times in the presence of some herbal juices leads to the generation of a specific compound form of the elemental lead of highly crystalline nature. Submicron size particle of the sample may be attributed to the grinding of raw materials for a long duration (similar to the top-down approach of the formation of nanostructured materials in modern nanotechnology) as well as the heat treatment which causes the change in the chemical nature of the raw materials.

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