ISSN: 2322 - 0902 (P)
ISSN: 2322 - 0910 (O)

International Journal of Ayurveda and Pharma Research

Research Article

MINERALOGICAL IDENTIFICATION AND CHARACTERISATION OF *SASYAKA*-AN AYURVEDIC DRUG

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ABSTRACT

The present study deals with the identification and mineralogical characterization of *Sasyaka* having various medicinal properties used in Ayurvedic system of medicine. *Sasyaka* synonyms *Tuttha* is one among *Maharasa* and that occurs in nature is called *Sasyaka* and that which is made artificially is called *Tuttha*, anyone can be used in place of the other. Chemically *Sasyaka* is copper iron sulphide and *Tuttha* is hydrated copper sulphate. *Sasyaka* reflects the color similar to the neck of peacock and is heavy in weight whereas *Tuttha* is blue stone or blue vitrol. *Sasyaka* is used therapeutically in the form of *Bhasma* for the treatment of diseases of eyes, skin diseases, ulcer, sinus, worm infection, vitiligo, obesity, diabetes, pain, asthma, hyperacidity, hemorrhoids, leprosy, chronic diarrhea, dysentery, leucorrhea and gonorrhea. However, raw drug identification and standardization play a vital role for assuring the therapeutic potential of the final drug. The sample of Sasyaka was collected from local market and authenticated by the subject expert and further analyzed by classical and modern methods. The results showed that the Sasyaka possess metallic luster, neck of peacock color, orthorhombic crystal structure, high specific gravity, irregular fracture and positive magnetism. All the physical properties of mineral Bornite together with Electron Probe Micro Analysis (EPMA) study are very well match with acceptable characteristics of *Sasyaka* as described in Ayurvedic classic. *Sasyaka* is thus identified as mineral Bornite (Cu_5FeS_4).

KEYWORDS: *Sasyaka, Maharasa*, Bornite, Mineral, Rasa Shastra.

INTRODUCTION

Rasa shastra is the branch of Ayurvedic pharmaceutics which deals mainly with *Maharasa*, *Uprasa, Shodhranarasa, Dhatus, Ratnas* and *Upratnas*. *Sasyaka* synonym *Tuttha* is one among the *Maharasa* (group of minerals) and that occurs in nature is called *Sasyaka* and that which is made artificially is called *Tuttha*, anyone can be used in place of the other. Chemically *Sasyaka*/*Tuttha* is found to be compound of copper with chemical compound formula of *Sasyaka* is Cu_5FeS_4 and *Tuttha* is $CuSO_4.5H_2O$. *Tuttha* is known as copper(II) sulphate, (chalcanthrite), blue vitrol and blue stone and it is obtained through processing the sulphuric acid over the copper. *Sasyaka* is known as naturally occurring copper iron sulphide, which reflects the color similar to the neck of a peacock and is heavy in weight. *Sasyaka* is also known as *Tutthaka, Tutthanjana, Mayuraka*, *Tamragarbha, Sikhigritta, Amritasanga* and *Kharparika* in Ayurveda. *Sasyaka* has an unpleasing taste of alkali and is bitter[1,2]. According to Ayurvedic Pharmacopoeia of India, *Sasyaka* shall not be used in formulations without subjecting it to *Shodhana* (incineration). The crude *Sasyaka* causes vomiting and giddiness[3,4]. *Bhasma* prepared after *Shodhana* is main therapeutic form of *Rasaushadi*[5] and used therapeutically for the treatment of various diseases.

The knowledge of *Sasyaka* was known to Indians since early ages of medical practice and was used liberally in many forms. Acharya Madhava elaborately explained to physical and chemical properties such as color, luster, cleavage, fracture, hardness, density, specific gravity, streak, crystal structure and chemical formulae of *Sasyaka*[6]. *Sasyaka* is used therapeutically in the form of *Bhasma* (incinerated), purified or added to herbal or herbo-mineral formulation in different doses form of Ayurveda. According to Ayurvedic classical texts *Sasyaka* is widely used in skin diseases, ulcer, sinus, worm infection, vitiligo, obesity, diabetes millitus, pain, asthma, hyperacidity, hemorrhoids, diseases of eyes, leprosy, chronic diarrhea, dysentery, leucorrhoea and gonorrhea[7]. In India, the mineral sources of *Sasyaka* are found mainly in Rajasthan, Bihar, Assam, Tamil Nadu, Bengal and Andhra

Pradesh. Now-a-days large proportion of *Sasyaka* is prepared synthetically and is widely available.

The Ayurvedic pharmaceutics mostly emphasized on *Grahya Lakshana* (acceptable properties) and some of the physical properties of raw substances to identify and selection of genuine sample so that further pharmaceutical procedures should be performed. Collection of authentic sample influences the quality of finished products, which is directly related to the therapeutic effect of a drug[8]. The analytical standard of *Sasyaka* is not reported till date. The present study was thus undertaken to assess the identification and characterization of *Sasyaka* for its mineralogical characterization through Ayurvedic as well as modern methods.

MATERIALS AND METHODS

The samples of *Sasyaka* were collected from the local market of Varanasi, Uttar Pradesh and authenticated by the subject expert. Further, the mineral was tested for its physical properties and then mineralogical characterization was made for acceptability of genuine sample by adopting the following mentioned methods.

Identification and physical verification of *Sasyaka* was carried out according to the methods of *Grahya Lakshana* (acceptable properties) mentioned in Ayurvedic classical text. Analysis of physical properties was conducted as per mineralogical description mentioned in the Ayurvedic Pharmacopoeia of India. The mineral chemistry of various phases in the studied sample was carried out by a Cameca-SXFive Electron Probe Micro Analysis (EPMA) at the Department of Geology, Banaras Hindu University, Varanasi.

RESULTS

Table1: *Grahya Lakshana* (acceptable properties) of *Sasyaka* as per Ayurvedic Classics

S. No.	Acceptable Properties	Physical Properties	Observations
1	*Mayurkanthasamchhaya*	Color resembling to the neck of peacock	+
2	*Bharadhyam*	High specific gravity	+
3	*Neela marakatachhaya*	Bluish color of aquamarine	+
4	*Snigdha*	Soapy touch	+
5	*Mahajwala*	Exceptionally shining	+
6	*Vamana, karakam &*	Which induces vomiting	+
7	*Guru*	Heavy	+

Table 2: The results of physical properties of Sasyaka and physical properties of Bornite and Chalcanthrite reported in classical text

S. No.	Physical Properties	Observed for *Sasyaka*	Reported for Bornite	Reported for Chalcanthrite
1	Nature of crystal	Opaque	Opaque	Transparent
2	Crystal Structure	Orthorhombic	Orthorhombic	Triclinique
3	Crystal form	Massive	Massive	Massive
4	Color	Blue (neck of peacock)	Blue (neck of peacock)	Bright deep blue
5	Streak	Grayish black	Grayish black	Pale blue
6	Hardness	2.5-3.0	3.0-3.5	2.5
7	Fracture	Irregular	Irregular	Chonchoidal
8	Cleavage	Poor	Poor	Poor
9	Magnetism	Positive	----	----
10	Luster	Metallic	Metallic	Vitreous
11	Specific gravity	5.0-5.10	4.9-5.4	2.12-2.3
12	Fizz test	Positive	----	----
13	Conductvity	Good conductor	----	----
14	Chemical Formula	Cu_5FeS_4	Cu_5FeS_4	$CuSO_4.5H_2O$

The collected sample of *Sasyaka* was characterized and verified by comparison as per the *Grahya Lakshana* mentioned in Ayurvedic literature[9]. Observations are shown in Table-1. The physical characterization was carried out as per the Ayurvedic Pharmacopoeia of India[10] and the mineralogical details of *Sasyaka* were verified by comparison with the reported mineralogical details of Chalcanthrite[6] and Bornite[11] reported in classical texts as shown in Table-2, Figure-1. The EPMA study for the mineral chemistry and elemental assay of various phases of the studied sample is presented in Table-3 and Figure-2.

Table 3: The elemental assay of mineral *Sasyaka* analysed by EPMA

Element S No.	Fe	Cu	S	Si	Al	Mg	Na	Pb
1	28.46	31.44	30.29	0.41	0.00	0.13	0.01	0.83
2	29.22	30.72	33.87	0.02	0.01	-0.01	-0.04	0.00
3	27.51	32.17	31.22	0.09	-0.02	0.12	-0.03	0.00
4	27.49	28.40	33.67	0.14	0.04	0.05	0.01	0.00
5	28.81	31.96	34.42	0.02	-0.01	-0.02	-0.04	0.00
6	28.33	30.74	32.71	0.19	0.05	0.21	0.01	0.00
7	28.54	31.09	35.00	0.08	0.02	0.02	0.02	0.00
8	28.26	29.93	27.77	0.21	-0.01	0.06	-0.03	0.00
9	29.99	30.12	32.47	0.06	-0.01	0.01	-0.03	0.00
10	28.82	31.31	32.53	0.13	0.04	0.07	0.03	0.00

DISCUSSION

The physical properties of minerals are directly related to their chemical and structural characteristics. The most useful physical properties for identifying the minerals are color, luster, streak, hardness, cleavage, fracture, crystal form and specific gravity. Some of the other properties such as heating in open and closed tube, magnetism, tenacity, taste and odor are helpful in identifying certain minerals[12]. The most of the physical properties of Sasyaka verified in this study very well match with the reported properties of Bornite in classical text[11]. A comparison of these properties were also done with physical properties of Bornite[11] and Chalcanthrite[6] as reported in Ayurvedic literature, which match well with Bornite (Table-2, Figure-1). The properties mentioned in classical text for *Grahya Lakshana* such as *Mayurkanthasamchhaya*, *Bharadhyam, Neela marakatachhaya*, *Snigdha*, *Mahajwala, Varmana karakam* and *Guru* are very well matched with hardness, luster, nature of crystal, specific gravity etc, physical properties of mineralogy of Bornite. Its metallic luster reflects the presence of metal (copper and iron). High specific gravity describes its heaviness, and transparency and crystal structure described its nature of crystals. It was observed that *Sasyaka* on heating in open tube gave no fumes which on cooling turned into light green whereas heating in close tube, it furnished black colored fumes. Roasting of *Sasyaka* gave white fumes with little garlic odor and color changes from grayish to brownish black. The present physicochemical study favored *Sasyaka* to be Bornite.

The EPMA study confirmed the presence of Cu, Fe and S in major proportion thus also establish Sasyaka as Bornite, Cu_5FeS_4. The required percentage of Cu was found less and Fe is more as per required chemical formulae. This may be due to collection of sample from different geological sources which are contaminated with impurities. The element Si, Al, Mg, Na and Pb are also present in trace amounts (Table-3, Figure-2).

Sasyaka is one among *Maharasa*, has been widely used in various diseases. It is extensively used in Rasagranthas. Its origin was *Garuda* consumed Amrita after drinking poison and vomited on *Marakata* mountain which gets solidified and turn into *Sasyaka* and has *mayurkanth* color and is very heavy. Ayurvedic literature describes that *Sasyaka* is synonyms as *Tuttha* and both can be used in the unavailability of other[7]. *Sasyaka* is naturally available whereas *Tuttha* is obtained synthetically.

The present study was carried out to focus the mineralogical characterization of mineral *Sasyaka* according to *Grahya Lakshana* as explained in classical texts of Rasa Shastra as well as the mineralogical standards as mentioned in the Ayurvedic Pharmacopoeia of India. Efforts has also been made for better understanding of *Sasyaka* by comparing the physicochemical analysis of *Sasyaka*, Bornite and Chalcanthrite. These results favoured the authenticity of *Sasyaka* as Bornite. *Sasyaka* is used therapeutically as *Bhasma* (incinerated ashes) after Shodhana (purification) with or without added herbs or at times herbo-mineral combination of dosage and

selection of suitable vehicles.[1] There are various importance of Bhasma like maintaining optimum alkalinity for optimum health, neutralizing harmful acids that lead to illness. The particle size of Bhasma reduced significantly, which may facilitate absorption and assimilation of the drug into body system.[13]

CONCLUSION

The acceptable properties of every metals and minerals have been mentioned in Ayurveda. It is therefore necessary to validate and establish those properties on the basis of modern methods in order to select the genuine sample. *Sasyaka* is reported to possess various medicinal activities and standardization plays a vital role in assessing final drug for better therapeutic effects. The analytical standard of *Sasyaka* is not reported till date. The present study was conducted for the mineralogical characterization of *Sasyaka* through Ayurvedic as well as modern methods. An attempt has been made to develop its mineralogical monograph.

ACKNOWLEDGMENTS

The author is thankful to Prof.N.V.Chalapathi Rao and Dr.D.Pandit, Department of Geology, Centre of Advance Study, Banaras Hindu University, Varanasi for EPMA study of studied sample.

REFERENCES

1. Mahapatra A, Mahapatra B. Physico-chemical analysis of crude Tuttha and Tuttha Bhasma prepared through three different procedures. Anals of Ayurvedic Medicine. 2013; 2: 141-146.
2. Vaishagh P, Nayak D J, Shobha KL. An antimicrobial evaluation of Tuttha Bhasma. Internatonal Journal of Ayurvedic and Herbal Medicine. 2018; 8: 3278-3282.
3. Tuttha. The Ayurvedic Pharmacopoeia of India, Part-1, Vol 7, Ist Edition, New Delhi, Government of India. 2009; p. 46.
4. Jha. CB. Ayurvedic Rasa Shastra, Chaukhambha, Surbharti Prakashan. 2003; p. 232.
5. Kashinath Shastri, Rasatarangini, Edn, Motilal Banarasidas Varanasi, 21st Chapter, Sloeka 145-147. 1979; p. 540-553.
6. Acharya Madhava, Ayurveda Prakasha, Edited by Gujral Sharma Mishra, Chaukhambha Bharti Academy, Varanasi, India, Ist Edition, Reprint, 2nd Chapter, 37 Verse, 2007; P.416.
7. Singh A, Desale V, Srivastava P. Standard manufacturing procedure protocol for Tuttha Bhasma – An Ayurvedic alchemy and its utility. Innovare Journal of Ayurvedic Sciences. 2018; 6: 1-3.
8. Pandey PS, Sharma V, Gopikrishna M. Vimal (Iron Pyrite): A medicinal mineral drug of Ayurveda – An approach to develop its monograph. Asian Journal of Pharmaceutics. 2018; 12: 1-5.
9. Acharya Somadeva, Rasendra Chudamani, Hindi Translation, Edited by Dr. Siddhinandana Mishra, Varanasi, Chaukhamba Oriental Publication, 10th Chapter, 1 Verse. 2013; p.136.
10. Anonymous. The Ayurvedic Pharmacopoea of India, Government of India, Ministry of Health and Family Welfare, Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy, New Delhi, Part-I, Vol. VII, 2008.
11. Rasa Vagbhata, Rasaratna Samucchaya, Ist Edition: by Dr. Indra Deva Tripathi, Edited by Dr. Kapil Deo Giri, Chaukhamba Sanskrit Bhavan, 2nd Chapter, 119 Verse, 1998; p.21.
12. Geology Laboratory: Mineral properties available from: https://www.saddleback.edu/faculty/jrepka/notes/GEOmineral LAB 1.pdf
13. Pal D, Sahu C K, Haldar. A Bhasma: The ancient Indian nanomedicine. Journal of Advanced Pharmaceutical Technology and Research. 2014; 5: 4-12.

Cite this article as:
Prem Shankar Pandey. Mineralogical Identification and Characterisation of Sasyaka-An Ayurvedic Drug. International Journal of Ayurveda and Pharma Research. 2019;7(12):75-78.
Source of support: Nil, Conflict of interest: None Declared

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