IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
Research Article
September 2015 Vol.:1, Issue:3

Physicochemical Analysis of an Ayurvedic Formulation – Abhraka Bhasma

IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

***Pankaj Rai[1], Laxmi Narayan Gupta[2], Neeraj Kumar[3]**

[1]Associate Professor, Department of Rasa Shastra and Bhaishjaya Kalpana , Major S D Singh Ayurvedic Medical College and Hospital, Farrukhaabad, Uttar Pradesh*

[2] Assistant. Professor, Dept. of Rasa Shastra, Faculty of Ayurveda, Banaras Hindu University, Varanasi.

[3] Professor, Dept. of Rasa Shastra, Faculty of Ayurveda, Banaras Hindu University, Varanasi, India.

Submission: 29 August 2015
Accepted: 3 September 2015
Published: 15 September 2015

Keywords: *Abhraka*, *Bhasma*, *Shodhana*, *Marana*, X Ray diffraction, Field Emission Electron Microscopy, Energy Dispersive X Ray Analysis

ABSTRACT

Ayurvedic medicines are important part of human life since vedic period. It has acquired importance in society due to its harmless nature and effectiveness. Metals and minerals are important ingredients of *ayurvedic* medicines used generally in the form of *bhasma* (ash) to treat human diseases.

Krishna Vajra Abhraka (Biotite) is an important and potent mineral used as medicine in the form of *bhasma* for different therapeutic purposes in the *Ayurveda* since long back without any annoying effects. For the preparation of *bhasma* it is subjected to different pharmaceutical processing like *Shodhana* (purification) and *Marana* (incineration) described in Ayurvedic texts that converted it into therapeutically important form. In this paper an attempt has been made to find out the physicochemical analysis of *Abhraka bhasma* by incorporating various modern analytical techniques like X Ray diffraction, Field Emission Electron Microscopy and Energy Dispersive X Ray Analysis along with ancient parameters described in the texts of Ayurvedic Pharmaceutics.

HUMAN JOURNALS

www.ijsrm.humanjournals.com

INTRODUCTION

Ayurveda is a medical science serving human kinds since pre-vedic era[1]. *Rasa-Shastra* (Ayurvedic Pharmaceutics) is one of the parts of Ayurveda, which deals with herbal / mineral/herbo-mineral/metals/non-metals preparations in different dosage form.

Around the medieval period (8^{th} – 10^{th}) century with the development of *Rasa* shastra many pharmaceutical processing like *shodhana* (purification), *marana* (incineration), *satvapatana* (extraction) etc. evolved in *Ayurveda* for metallic and mineral preparations. Development of these processes made drugs more harmless and therapeutically effective. Since after this, use of theses preparations become more frequent in therapeutics and drugs prepared from these were known *Rasaushadies*. These *Rasaushadies* have innate qualities like quick action, lesser dose, tastelessness, prolonged shelf-life & better palatability[2]. These qualities of metallic and mineral preparation of medicines boost Indian system of medicine for serving as global medical system. In *Ayurvedic* pharmaceutics the process of *Shodhana* (purification) has its importance because the *dravyas* used for medicinal purposes are of metal, mineral, vegetable and animal origin. Process of *Shodhana* (purification)[3] is an essential to remove the external impurities as well as to make the drug ready for other pharmaceutical processes. It is a process of purification and detoxification by which physical and chemical blemishes and toxic materials are eliminated & substances are subjected for further processing. *Marana* [4](Calcination) is a process of heat treatment of Shodhit (Purified) material at different temperature pattern known as Puta[5] which convert it into *Bhasma* (ashes) form which is therapeutically accepted form. *Abhraka* (Biotite) is an important mineral used for medicinal purposes since long back in many diseases [6] in the form of *Bhasma*.

MATERIALS AND METHODS

MATERIALS

First of all black color *abhraka* (biotite) was procured from *Ayurvedic* Pharmacy, I.M.S., B.H.U. and subjected to fire test for finding out its quality. For this test, measured quantity of *Abhraka* was heated strongly for 15-20 minutes. The sample was found unchanged in this test were selected for *Shodhana* purpose. Apart from *Abhraka*, *Triphala kwath* (decoction) was also prepared as per classical methods.

Shodhana (Purification) Process of _Abhraka_

Shodhana was carried out by *Nirvapa* (heating and quenching into liquid)[7]. *Triphala kwath* was prepared as per the reference *Sharangadhara Samhita*[8]. 1 Kg of *Abhraka* was heated in an iron pan to red-hot stage and quenched in each liquid media for 7 times. *Abhraka* flakes were turned up & down with metal

Tongs to given equal exposure of heat to both the surfaces. It was done in regular intervals and was quickly quenched into the media with the help of metal tongs when the *Abhraka* flakes reached at the stage of red hot. After complete immersion of *Abhraka* into media the media was separated by filtering it through iron sieve and soft pieces of *Abhraka* were collected in an iron pan to subject it for next *nirvapa*. Temperature at the time of red-hot stage was taken by a thermocouple. Each time, liquid media was taken fresh. 920 grams of *abhraka* found after *shodhana* process.

Process of a _DhanyaAbhraka_

900 grams of *shodhit abhraka* was further subjected to the process of *Dhanyabhraka* as per reference of *Rasa Ratna Sammucchaya*[9]. *Shodhit Abhraka* and its ¼ quantity of *Dhanya* (paddy) was mixed together. The mixture was transposed on Jute cloth and a pottali was tied with the help of a jute yarn. This pottali was dipped into *Kanjii* (sour gruel) kept for 3 days. After three days the bag is massaged inside the *Kanjii* so that fine powder of *Abhraka* exudes out through the pores of the bag and collects in the vessel. This is later taken out and dried in sun. Fine shining powder of biotite thus obtained is called *Dhanyabhraka*.

Process of _Abhraka marana_

Abhraka Bhasma was prepared as per the reference of *Ayurveda Prakash*[1] by the principle of *Puta* (incineration) in an Electrical Muffle Furnace (EMF). 500 grams of *Dhanyabhraka* was weighed and was levigated with juice of leaves of *Arka* (*Calotropis procera*). After levigation pellets of uniform size & shape were made. Pellets were kept on plastic sheets for drying under sunlight. Dried pellets were kept in *sarav* (Silica casserole) and covered with another one and put in electric muffle furnace for heat treatment. Temperature of 900^0C for 45 minutes was

maintained in each *puta*. Process was repeated for 24 times. Finally Brick red color *bhasma* was obtained.

Samples of raw material, *Shodhit* material and *bhasma* were collected in a sterile jar and named as sample 1, 2 and 3 correspondingly.

Analytical Method:

1. Classical Method
2. Analytical Techniques

Classical Method

After preparation of *Abhraka Bhasma*, it is subjected to *Bhasma* pariksha. Following test have been performed as per given in texts of *Ayurvedic* pharmaceutics.

- ***Rekhapurnatva*** – After preparation, *Bhasma* was rubbed in between thumb and index finger, as a result it was filled in between lines of fingers and thumb.
- ***Varitaratva* (floating on water)** – Small amount of the prepared *Bhasma* was taken and sprinkled over the silent water taken in a beaker. It was found that 70 % of the *Bhasma* particles float over the surface of water.
- ***Nischandratva* (lustureless) –** Luster / shining has not been observed in prepared *Bhasma*.
- ***Nisvadutvam* (tasteless) –** The prepared *Bhasma* was found tasteless when a small amount was kept over the tongue.
- **Dantagre na kach kacha iti** (no sandy feeling in between teeth) **–** When a small amount of *Bhasma* was placed between the teeth, no any sandy feeling was appreciated.

X-ray Diffraction (XRD)[11]: is a powerful non-destructive technique for investigation of structural properties of crystalline materials. Diffraction pattern is produced when a crystalline material is irradiated with a collimated beam of X-ray. The diffraction pattern and the intensity of each diffracted X-ray as a function of the diffraction angle can provide information such as crystal structures, phase purity, grain size etc.

A small quantity of samples was crushed to very fine size powder in an agate mortar. These

powders were then mounted on the sample holder of a commercial high resolution X-ray power diffractometer fitted with a curved monochromator. This diffractometer operates on "Bragg-Bretano geometry". An eighteen KW rotating anode generator was used as a source of X-ray. This machine was of Rigaku make with model No. Rint 2000/PC series. The XRD data were collected in the fully automatic mode and stored in the personal computer.

Field emission scanning electron microscopy and Energy dispersive X-ray analysis:

The samples were analyzed using FESEM coupled with EDAX (model: Quanta – 200ESEM). Before analysis, the samples were converted into fine powder form by means of a glass mortar. A small amount of the sample was mounted to the stub with silver glue, prepared with silver powder and isopropyl alcohol.

RESULTS AND DISCUSSIONS

Bhasma passed all the parameters laid down in ancient classical text of *Ayurvedic* Pharmaceutics.

XRD Study:

XRD pattern is summarized from Fig. 1 to 3. JCPDS standards available show after comparing with findings that the raw material used is Potassium Iron Magnesium Aluminum Silicate Hydroxide having following formula:

$$\mathbf{K\ (Mg,\ Fe^{+2})\ 3\ (Al,\ Fe^{+3})\ Si_3O_{10}\ (OH,\ F)_2}$$

On comparing the XRD data available for all samples reveal that strongest three peaks of raw *abhraka* and *shodhit* (purified) *abhraka* are nearby same.

After comparing the data of *Abhraka bhasma* with JCPDS standards it was found that compounds formed in *bhasma* are **Fe_2O_3 and SiO_2**.

FESEM Study: Photographs of FESEM is shown from Fig. 4 to 6.

Sample 1 (Raw material): shows the layered structure at lower magnification. Some granular particles are also present within the layered structure. This type of structure can be seen at higher magnification.

Sample 2 (*Shodhit abhraka*): layered like structure. The granular particles have been decreased as compare to raw material

Sample 3 (*Abhraka bhasma*): *Bhasma* prepared by *Arka* Patra *swarasa* shows structure of cluster which are dense in nature. Particle sizes were 50-100 nm.

EDAX Study: EDAX study provides the knowledge regarding elemental composition. Result is summarized in Table 1 and 2.

DISCUSSIONS

XRD study reveals that there is not much structural change in raw and *shodhit abhraka.* But there is some addition and deletion of peaks is occurring. This may be due to the addition and deletion of some compounds in very minor amount which could not be traced after comparing with JCPDS data.

Compounds are formed in the *bhasma* due to oxidation process in heating during *Marana* process. Major compounds formed is Iron oxide Fe_2O_3. Silica oxide SiO_2 is also formed. Formation of Silica oxide reveals that *bhasma* is *Chandrikarahita* (lusturless) as silica converted into compound form and suitable for medicinal purposes.

FESEM Study:

On observation, Field Emission Scanning Electron Microscopy of the raw and *shodhita abhraka* reveals that, the plate late structure of *Abhraka* remains intact even after *Shodhana* process. However they became more granular and appear to be microcrystalline. *Bhasma* shows cluster like structure

The particle size of the raw material was in between 6 and 10 µ while that for the *Bhasma* was 50-100 nm. Due to smaller particle size, these particles are coagulated to form clusters of particles.

EDAX Study:

It appears from the table of analysis (Table 1 and 2) that, the major elements present in the raw sample) are Mg, Al, C, K and O. It seems that *abhraka* is a mineral containing Mg, Fe, Al and Silicate with carbon present in it from the natural organic matter. The wt % of several elements

taken together indicates the presence of the predominant silicate group along with Alumino-Silicate group with Fe and Mg as ionic species.

After *Shodhana* with *Triphala kwath* (decoction) sample shows variation of Fe, Mg, Al, Si and K along with the addition of trace element due to naturally present in *Triphala kwath*.

Shodhana (purification) and *Marana* (calcination) processes do really affect the composition of the elements in final product. Sometimes free metals are decreased and sometimes they show increase in concentration.

- Increase in % of Oxygen during *shodhana* and *marana* processes reveals the process of oxidation.
- Trace elements recognized in liquid medium were also found in *Bhasma* other than constituents of *Abhraka* shows reaction between *Abhraka* and medium.

CONCLUSION

Analytical results of *Abhraka Bhasma* fulfill the criteria mentioned in the *Ayurvedic* Pharmacopoeia of India. The latest analytical techniques like XRD, FESEM and EDAX are very appropriate tools for reliable analysis of the structural and chemical composition of *Abhraka Bhasma*. The obtained results show that the *Abhraka bhasma* does not contain any toxic metal even in trace levels and is of standard quality. The data of the present study suggests that the characterized *Abhraka Bhasma* sample, constituting nanoparticles, and is in harmony with nanotechnology of contemporary era.

REFERENCES

1. *Ayuverda* ka *Vaijyanik* Itihs, Prof. P.V. Sharma , Chaukambha Orientalia, Varanasi, 8, 2001.
2.Tripathi, I.D.: Gopalkrishna Bhata's *Rasa*edra Sar Sangraha, Chaukambha Orientalia, Varanasi, 4, 2003.
3-4. Shastri, K.N.: Sadanand Sharma's *Rasa* Tarangani, Motilal Banarasi Das, Varanasi, 22, 2002.
5-7.Kulkarani, D.A.: *Rasa* Vagbhata' *Rasa* Ratna Sammucchaya , Meharchand Lacchman Das, New Delhi, 1992
8. Dr. Shailaja Srivastava, Acharya Sarngadhar's Sgarngdhar Samhita, Chaukhamba Orientallie, 3rd Edition, 2003.
9. Kulkarani, D.A.: *Rasa* Vagbhata' *Rasa* Ratna Sammucchaya , Meharchand Lacchman Das, New Delhi, 1992
10. Sharma, Gulraj. : Madhava's Ayurveda Prakash, Chaukambha Bharati Academy, Varanasi, 1999.
11. Westgren A (1932). "ZurChemie der Legierungen" Angewandte Chemie 45 (2): 33.

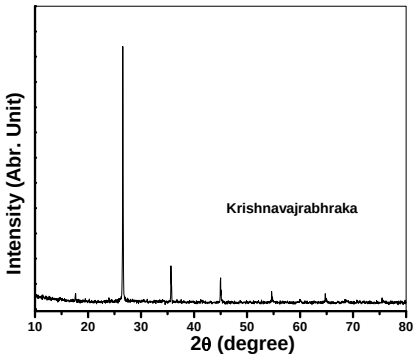

Fig.1 XRD Pattern of Raw material

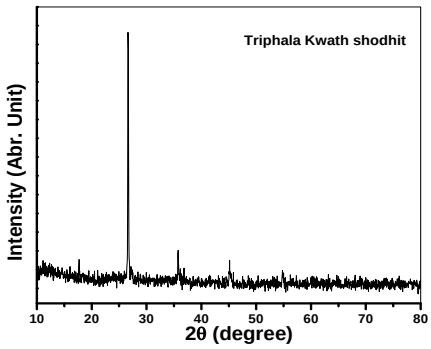

Fig.2 XRD Pattern of *Shodhit Abhraka*

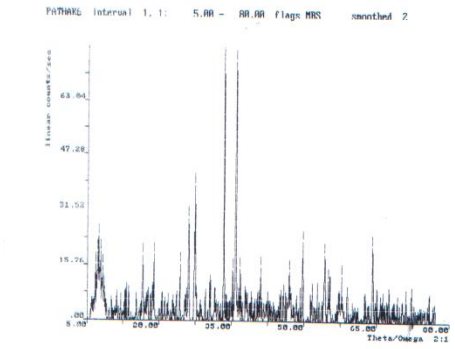

Fig.3 XRD Pattern of *Abhraka Bhasma*

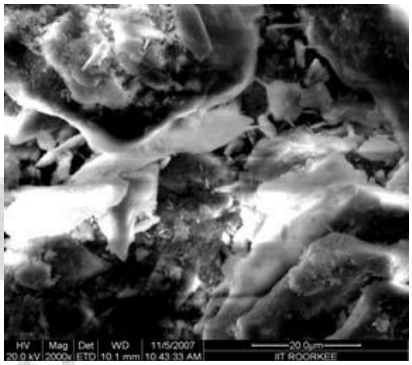

Fig.4 FESEM Photograph of Raw Material

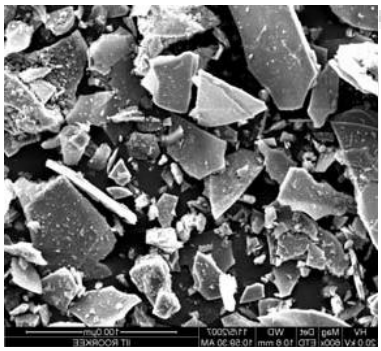

Fig.5 FESEM Photograph of *Shodhita Abhraka*

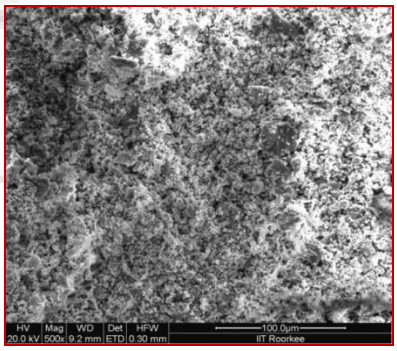

Fig.6 FESEM Photograph of *Abhraka Bhasma*

Table 1. Major elemental composition found in EDAX

Element	Raw Material	*Shodhit Abhraka*	*Abhraka Bhasma*
C	6.23	14.87	1.23
O	38.94	31.35	38.94
Fe	16.27	13.84	19.27
Si	18.0	13.38	13.72
Al	9.01	7.01	4.11
Mg	6.06	3.98	1.72
K	6.32	6.89	6.08

Table 2. Minor elemental composition found in EDAX

Element	Raw Material	*Shodhit Abhraka*	*Abhraka Bhasma*
F	1.30	-	1.64
Cl	0.19	-	2.87
Pd	0.39	-	-
Ti	1.23	-	-
P	-	0.19	-
Nb	-	2.23	-
Ru	-	0.21	-
Cs	-	0.49	-
Ba	-	2.91	-
V	-	0.16	-
Pb	-	2.48	-
Co	-	-	-
Sb	-	-	-