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Analytical Study of *Rajata Bhasma* w.s.r. to Ayurvedic and Modern Parameters.

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ABSTRACT

Rasa aushadhi are well known for its smaller dose, quick effect, tasteless i.e. without causing any nausea after administered. *Rasa aushadi* are defined as any formulation prepared from drugs which are explained in classical texts with their *grahya-agrahya* characters along with their benefits and side effects if not taken properly e.g. *Parada, maharasa, uprasa, sadharana rasa, lohadi varga* etc. These drugs are said to be used in *Bhasma* form, so to make it suitable for internal use they are subjected to various procedures like *shodhan, Marana etc*. When these drugs are subjected to marana process, they are converted into *bhasma* form and also well known for its quick effectiveness, smaller dose and long shelf life. However, if these *Bhasmas* are not well prepared and analysed precautionly they can be toxic to human body. Therefore *Bhasma Pariksha* or its examination can be done on both parameters *Ayurvedic* and Modern parameters. So in this study prepared *Rajata* (Silver) *Bhasma* is analyzed on various parameters i.e. *Ayurvedic* parameters i.e., *Varitaratwa, Rekhapurnatwa, Slakshantwa, Laghutwa, Niruthtava etc.* and some modern parameters like *pH, Particle size, X-ray Diffraction (XRD), Energy dispersive X-ray spectroscopy*.

KEYWORDS

Bhasma, Bhasma-Priksha, Analysis,parameters

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INTRODUCTION

Analytical study is the application of a process or a series of processes in order to identify, quantify a substance, the components of a solution, mixture, the determination of the structures of chemical compounds. Quality of a drug depends upon its formulation, processing and applications. It is essential to fix some standards for manufacture of drugs, so that the genuineness of the drug is not compromised. *Ayurvedic* texts have described several methods for quality control of finished products like *Mriduta, Varitara, Unam, Nirutha, Apunarbhava* etc. to achieve a specific acceptable standard *Bhasma*[1]. The advancement of science and sophisticated technology provides standard database of the herbs, minerals, herbo-minerals, metals, herbo-metallic, marine or animal origin drugs and even various finished products and formulations. This will not only provide a scientific basis and credibility to *Ayurvedic* drugs and pharmaceutics but also help in the globalization of *Ayurveda*.

MATERIALS & METHODS

The process was carried out in two ways :

- *Ayurvedic parameters*
- *Modern parameters*

Procedure to prepare *Rajata Bhasma*

Shodhana

Certified *Rajata Patra* were taken it was taken in iron ladle and heated till red hot and quenched into *nimbu sawrasa*[2]. This whole process of *shodhana* was repeated for 7 times. For every process fresh *nimbu sawrasa* was used.

Parada shodhana was done in *Chuna* (lime) powder and *lashun kalka*[3]. This process performed in two steps, in the first step *ashudh parada* was triturated with lime powder for three days and washed with warm water. In next step, obtained *parada* was triturated with *lashun kalka* and *saindhav lavan*, till it converted into black colour, again washed with warm water and *shudha parada* was obtained.

Amlasaar ashudh gandhak was taken in ghrita smeared iron ladle and melted on *mandagni*. Simultaneously, *godudha* was taken in s's'' container and boiled it. The white muslin cloth was tied over mouth of container and molten *gandhak* was passed through it. The *shudha gandhak* was obtained in hot milk and washed through hot water to remove all its *singdhatva* and dried. It was repeated for three more times[4].

Marana

Here for *maran* process some modification was done regarding the preparation of *Rajata bhasma*. *Shodhita Rajat patra* were taken in *khlava yantra* and equal amount of *Shudh Parad* was taken and grounded well

till became homogenous amalgam like material. Equal amount of *shudh gandhak* was also taken in *khalva yantra* was again triturated to obtained homogenous material. It was levigated with *ghrit kumara sawrasa*[5]. Thereafter *chakrika* were prepared and kept in *sharava samputa*. *Sandhibandhan* was done with *multani mitti* smeared cloth and kept for puta. Puta were given in electric furnace initially with low temperature to high temperature. Total *17 puta* were given to form *Rajata Bhasma*.

Ayurvedic* Parameters for the Analysis of *Rajata Bhasma

Test for organoleptic characters

Rajata were observed for their colour, any perceptible fine powder, any particular odour, any specific taste and sound as results described in table 1.1.

1. *Mritaloha/Rekhapurnatva* test[6]: Very little amount of the *Rajata Bhasma* was taken in between index finger and thumb. It was rubbed and observed whether the *Bhasma* fill the furrows of the finger tips or not.

2. *Varitara* test[7]: Water was taken in a glass beaker of 100 ml and allowed for stagnation. Then very small amount of *Rajata Bhasma* were sprinkled from a distance of 2cm on the surface of stagnant water in beakers and observed.

3. *Unam* test[8]: Some grains of rice were taken and kept carefully on the layer of floated *Bhasma* and was observed whether the grains float or not.

4. *Nishchandrata* test[9]: Bhasma was rubbed in between thumb and index finger, then observed in sunlight for presence of any lustered particles.

5. *Niruttha* test[10]: 1.22g of *Bhasma* was taken in a *crucible* and Rajata patra weighing about 0.35gm and it was subjected to the similar grade of heat for the preparation of *Rajata Bhasma*, after self-cooling, Rajata patra was collected and weighed, no change in weight was observed i.e. collected material was 1.22gm which suggests that *Bhasma* have positive *Niruttha* test.

6. *Apunarbhava*[11]: It is test in which metal was incapable to regain its original state when kept under puta with *mitrapanchak.*

Procedure

Rajata Bhasma, 1gm, was taken and ingredients of *mitrapanchak each* were taken in equal quantity. They were subjected to similar grade of heat as given during *puta*.

Result: There was no free metal was observed in material

Table 1.1 Shows the analysis of *Rajat Bhasma* on these classical parameters

Parameters	**Rajata Bhasma**
Characterstic	*Powder*
Varna (Color)	*Dark Brown*
Rasa (Taste)	*Kashaya, tikata*
Gandha (Odor)	*Odourless*
Sparsh (Touch)	*Very Soft*
Varitaratva	*100%*

Rekhapurnatva	*Positive*
Nishchandratva	*Positive*
Nirutha	*Positive*

Modern analytical parameters:

To analyse the present drug on the basis of modern parameters, analysis of drug was carried out at Drug testing lab. Joginder nagar and Sophisticated Instrumentation Centre for Applied Research and Testing (Sponsored by Deptt of Science and Technology, Govt of India, New Delhi) Dist. Anand, Gujarat, India.

Parameters and Methods adopted

❖ Macroscopic and Microscopic description, Physicochemical tests

❖ Qualitative/Quantitative tests

• EDAX

• PSA (Particle size Analysis)

Macroscopic and Physicochemical Description [12] (as per table no. 1.2)

1. Macroscopic and microscopic analysis of given sample of *Rajata Bhasma*, the following tests were performed-

❖ Description

❖ Colour

❖ Odour

❖ Taste

2. Ash value

This test was conducted to assess the total ash content of the sample.

Procedure It was determined by incinerating accurately weighed sample in tarred silica crucible in an electric muffle furnace at 700^0C, then allowed to self-cooling and weighed. The percentage of ash was calculated and expressed as %w/w.

3. Acid insoluble ash

This test was carried out to assess the percentage of acid insoluble inorganic content of the sample.

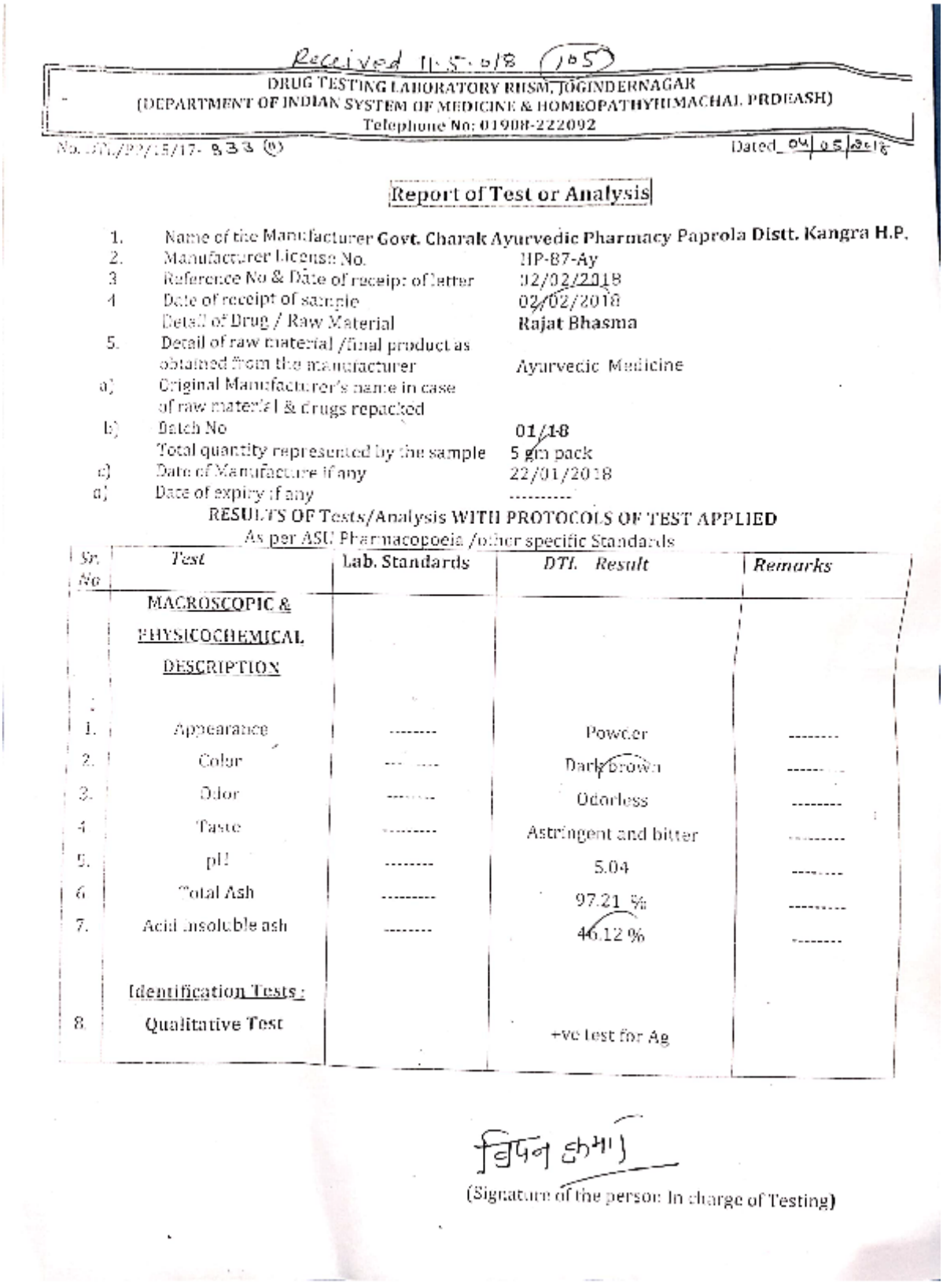
Procedure

The ash obtained for determination of ash value was boiled for 5 minutes with 5ml of dilute hydrochloric acid, the insoluble matter was collected on ash less filter paper, washed with hot water and ignited to get constant weight. The percentage of acid insoluble ash was calculated and expressed as %w/w.

This image 1 has shown the analytical report of macroscopic and physiochemical description of the *Rajata Bhasma*: (Provide the same in tabular form and not an image)

Table 1.2 shows the macroscopic and physicochemical description by DTL report as shown in image 1

Macroscopic and physicochemical description	DTL report
Appearance	Powder
Colour	Dark brown
Odour	Odourless
Taste	Astringent and bitter
pH	5.04
Total ash	97.21%
Acid insoluble ash	46.12%
Qualitative test	+ve for Ag



Received 11.5.018 (105)

DRUG TESTING LABORATORY RIISM, JOGINDERNAGAR
(DEPARTMENT OF INDIAN SYSTEM OF MEDICINE & HOMEOPATHYHIMACHAL PRDEASH)
Telephone No: 01908-222092

No. DTL/P.T./5/17- 833 (i) Dated 04/05/2018

Report of Test or Analysis

1.	Name of the Manufacturer	Govt. Charak Ayurvedic Pharmacy Paprola Distt. Kangra H.P.
2.	Manufacturer License No.	HP-87-Ay
3	Reference No & Date of receipt of letter	02/02/2018
4	Date of receipt of sample	02/02/2018
	Detail of Drug / Raw Material	Rajat Bhasma
5.	Detail of raw material /final product as obtained from the manufacturer	Ayurvecic Medicine
a)	Original Manufacturer's name in case of raw material & drugs repacked	
b)	Batch No	01/18
	Total quantity represented by the sample	5 gm pack
c)	Date of Manufacture if any	22/01/2018
d)	Date of expiry if any	----------

RESULTS OF Tests/Analysis WITH PROTOCOLS OF TEST APPLIED
As per ASU Pharmacopoeia /other specific Standards

Sr. No	Test	Lab. Standards	DTL Result	Remarks
	MACROSCOPIC & PHYSICOCHEMICAL DESCRIPTION			
1.	Appearance	--------	Powder	--------
2.	Color	--------	Dark brown	--------
3.	Odor	--------	Odorless	--------
4	Taste	--------	Astringent and bitter	--------
5.	pH	--------	5.04	--------
6	Total Ash	--------	97.21 %	--------
7.	Acid insoluble ash	--------	46.12 %	--------
	Identification Tests :			
8.	Qualitative Test		+ve test for Ag	

(Signature of the person In charge of Testing)

Scanned by CamScanner

Image 1

EDAX[13]

Energy Dispersive X-Ray Spectroscopy, sometimes called Energy Dispersive X-Ray

Analysis or Energy Dispersive X-Ray Microanalysis, is an analytical technique used for elemental analysis or chemical characterization of a sample. Its characterization capabilities are due in large part to the fundamental principle that each element has a unique atomic structure allowing a unique set of peaks on its electromagnetic emission spectrum.

Working principle

A high-energy beam of charged particles such as electrons or protons or a beam of X-rays, is focused into the sample being studied. At rest, an atom within the sample contains ground state (or unexcited) electrons in discrete energy levels or electron shells bound to the nucleus. The incident beam may excite an electron in an inner shell, ejecting it from the shell while creating an electron hole where the electron was present. An electron from an outer, higher energy shell then fills the hole, and difference in energy between the higher energy shell and the lower energy shell may be released in the form of an Xray. The number and energy of the X-rays emitted from a specimen can be measured by energy –dispersive spectrometer. As the energies of the X-rays are characteristic of the difference in energy between the two shells and of atomic structure of emitting element, EDS allows the elemental composition of the specimen to be measured.

Result

Chemical composition of *Rajata bhasma* was examined by Electron dispersive x-ray spectroscopy as shown in table no.1.3 in image 2. It showed the presence of Ag, O, S, Si, Hg etc. Although mean weight percentage of Silver 36.92 as shown in reports.

Table 1.3 Shows the mean results of EDX reports as shown in image 2

Chemical composition	Weight Percentage
Ag	33.73
O	31.52
S	11.81
Si	3.54
P	0.12
Fe	3.06
Hg	4.33

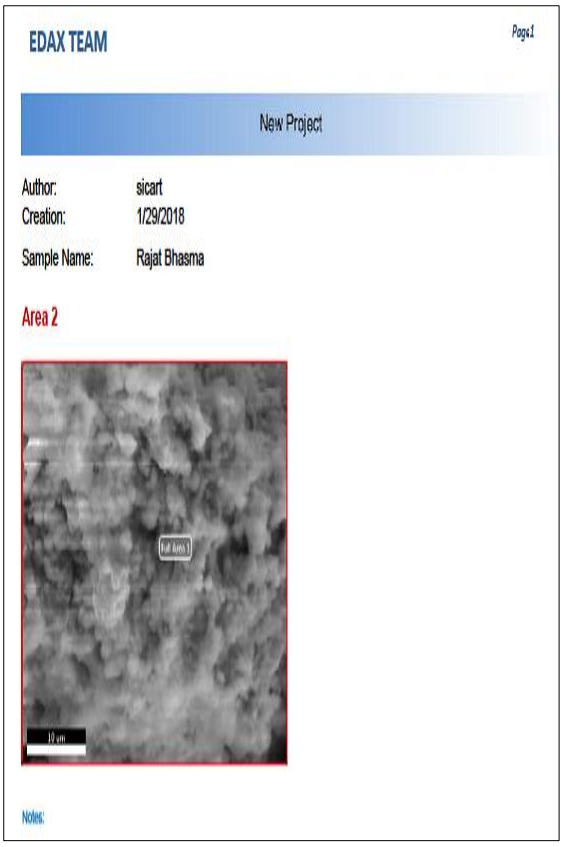
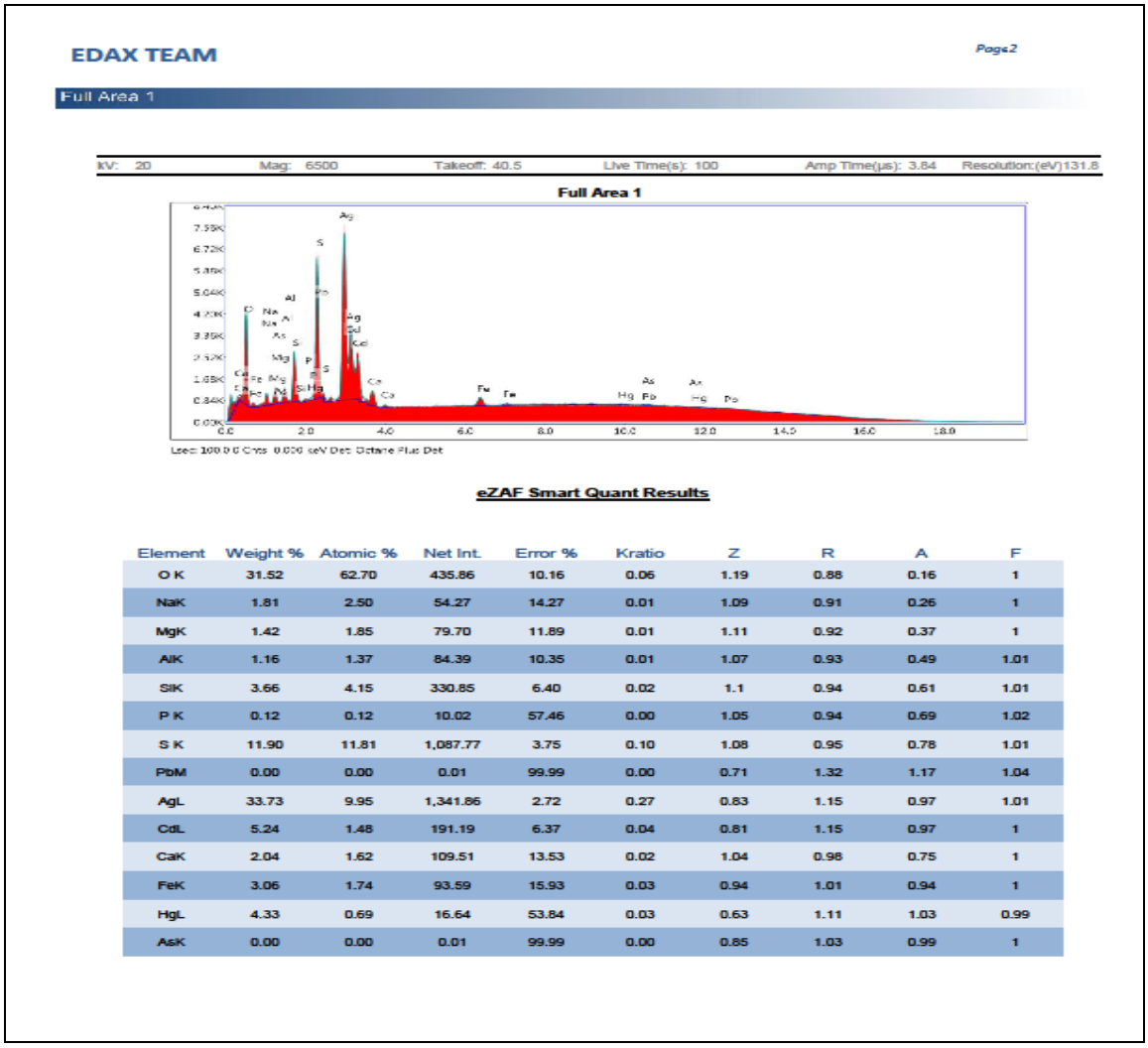


Image 2



EDAX TEAM

Page2

Full Area 1

kV: 20 Mag: 6500 Takeoff: 40.5 Live Time(s): 100 Amp Time(µs): 3.84 Resolution:(eV)131.8

Full Area 1

eZAF Smart Quant Results

Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	R	A	F
O K	31.52	62.70	435.86	10.16	0.06	1.19	0.88	0.16	1
NaK	1.81	2.50	54.27	14.27	0.01	1.09	0.91	0.26	1
MgK	1.42	1.85	79.70	11.89	0.01	1.11	0.92	0.37	1
AlK	1.16	1.37	84.39	10.35	0.01	1.07	0.93	0.49	1.01
SiK	3.66	4.15	330.85	6.40	0.02	1.1	0.94	0.61	1.01
P K	0.12	0.12	10.02	57.46	0.00	1.05	0.94	0.69	1.02
S K	11.90	11.81	1,087.77	3.75	0.10	1.08	0.95	0.78	1.01
PbM	0.00	0.00	0.01	99.99	0.00	0.71	1.32	1.17	1.04
AgL	33.73	9.95	1,341.86	2.72	0.27	0.83	1.15	0.97	1.01
CdL	5.24	1.48	191.19	6.37	0.04	0.81	1.15	0.97	1
CaK	2.04	1.62	109.51	13.53	0.02	1.04	0.98	0.75	1
FeK	3.06	1.74	93.59	15.93	0.03	0.94	1.01	0.94	1
HgL	4.33	0.69	16.64	53.84	0.03	0.63	1.11	1.03	0.99
AsK	0.00	0.00	0.01	99.99	0.00	0.85	1.03	0.99	1

Image 2

Particle Size Analysis[14]

Laser diffraction is the preferred standard method for particle size estimation in the pharmaceutical industry, due to its short analytical time, robustness, high precision, reproducibility, wide measurement range and flexibility of operation using liquid spray and dry dispersion attachments.

Working Principle

Laser diffraction particle size analysis, ensemble of particles passes through a broadened beam of laser light, which scatters the incident light on a Fourier lens. This lens focuses the scattered light on a detector array and using an inversion algorithm particle size distribution is inferred from the collected diffracted light data. Light scattered by particles form a series of concentric rings of alternating maximum and minimum intensities, it is called as 'Airy disc'. The first minimum ring provides information required to determine the mean size of the distribution. Subsequent maxima and minima contain information on the shape and width of the distribution. It is this series of maxima and

minima that needs to be accurately measured in order to report the true shape of the particle size distribution.

Results

PSA report shown image 3 (table no.1.4) as revealed that the volumetric mean diameter size of *Rajata Bhasma* after 17 *puta* was 17.28µm and the smallest particle size was 2.30 µm.

Table 1.4 Shows the result of Particle size analysis as shown in image3

%Below	Size(µm)	Volumetic mean diameter(µm)
10	2.30	17.28
16	3.38	
50	11.91	
84	31.51	
90	40.60	
99	87.44	

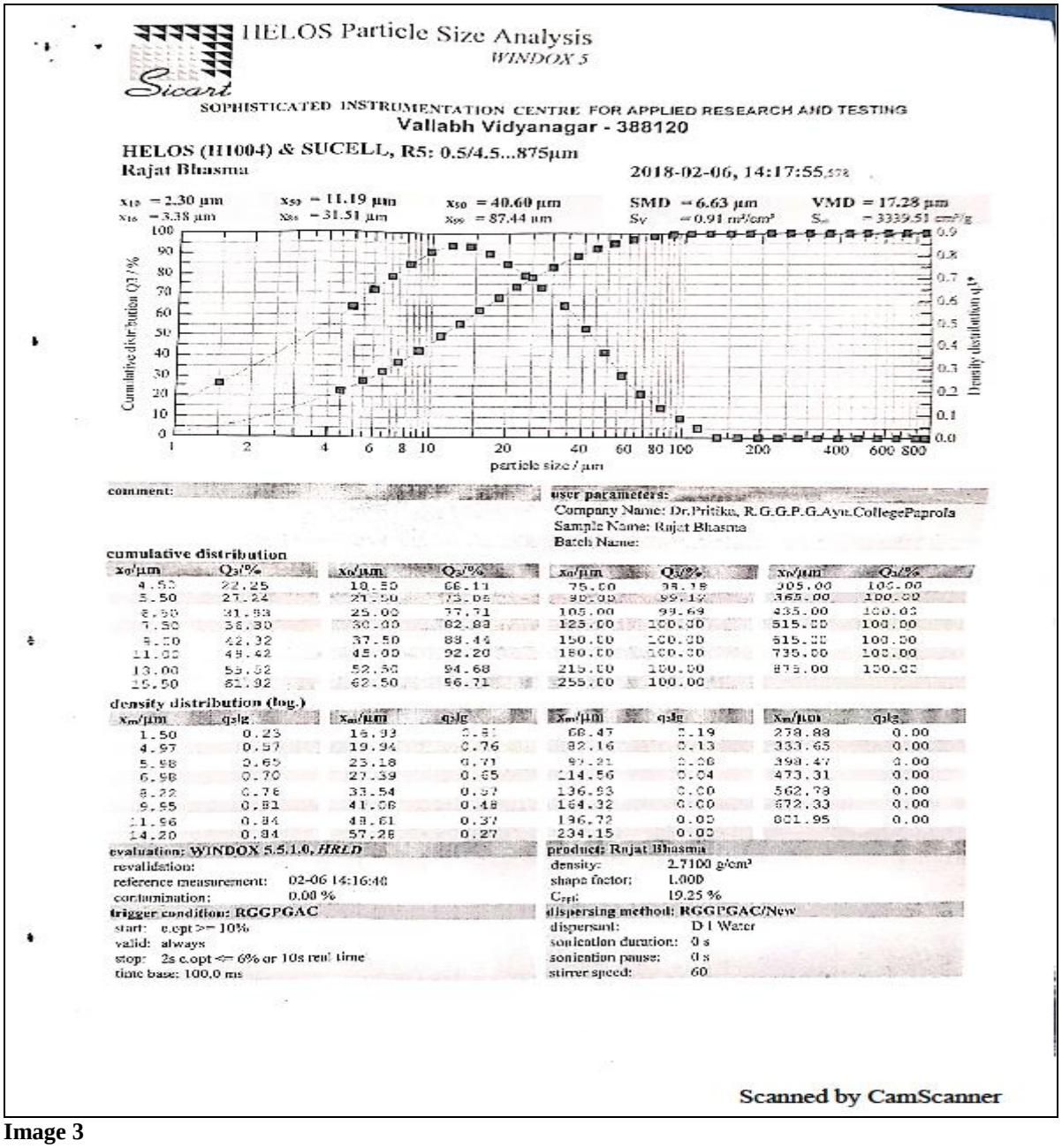


Image 3

DISCUSSION

Analytical study is an essential part of any research work. It provides us experimental data and makes us know about certainty of our assumptions and prevents from miss interpretations. It provides us with knowledge about identity, size, structure of chemical constituents and physical properties. Ancient time, there were no modern techniques to identify the standards of prepared medicines. That time ancient methods have more importance and *vaidya* completely relied on it. *Rekhapurnta, shlakshnta, varitarta, nishchandrika* etc are the *bhasma pariksha* methods and well prepared *bhasmas* are those who have passed these characters. *Rajata bhasma* has passed the classical analytical parameters, so it can be used safely.

With the passage of time, so many modern techniques have developed and still developing. To standardise any formulation or single drug *Ayurvedic Pharmacopeia of India* is good initiation. The modern analytical parameters are based on as per defined in API standard protocols. To authenticate any drug or formulation proper documentation should be maintained. This modern parameters are clearly defined its macroscopic, physiologic characteristics of the *Rajat Bhasma*. Further details for its chemical composition after incineration (puta method), only shown by Energy dispersive X-ray spectroscopy and this will only possible after development of modern parameters. The reduction in particles size are clearly observe in the drug after subjected to various procedure of *bhasma* preparation, this was studied and particle analysis report have shown that the large fragments of Rajat reduced to powder form in micrometres.

CONCLUSION

The *Rajata bhasma have* passed *Bhasma pariksha* viz. *Varitaratwa, Rekhapurnata, Nischandrata* and *Slakshanatwa* which proves that drug has attained its *supakwa Bhasma lakshna* which is essential for making a drug safe and efficacious. The analytical study illustrates the vision of the *Rasa Vaidya* regarding the various pharmaceutical procedure adopted in the preparation of *Bhasma* in making them completely safe for therapeutic usage which was reflected in all the sophisticated analytical tests employed in this research work.

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