



A METHODOLOGICAL QUALITATIVE AND QUANTITATIVE STUDY OF SUBLIME "VIOLET POISON" W.S.R. TO RASAKARPURA

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ABSTRACT

Rasakarpura is one of the Nirgandha murchana bheda of Parada. It appears as a white sublimate with chemical composition of mercuric chloride. The artificially prepared rasakarpura is commonly available in the market, prepared sublimed from metallic mercury, sulphuric acid and rock salt. This compound is widely used for many ayurvedic preparations. It is also known as Mercury bi-chloride or Mercury per-chloride. It appears as crystals or white granules or as powder; in the toxicology field it has a nickname "violet poison". The work was taken up to fix up the standards for assessment of quality control over a Rasakarpura in order to interpret the pharmacokinetics and pharmacodynamics of the drug. The analysis of the drug Rasakarpura to establish standards in terms of Organoleptic characters, physico-chemical analysis, elemental analysis, XRD were carried out in IIT (SAIF), Powai, Mumbai and BTH, Bangalore. The result revealed that pH of the sample was more nearer to the neutral side. Particle size was 18 micron to 31 micron which may facilitate better absorption in the body. X-RD showed presence of HgCl₂ as a main constituent along with other trace elements. These results were interpreted systematically and are presented in the paper.

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INTRODUCTION

Parada, Mercury, Sublime, Rasakarpura, Analytical study. Rasashastra is a most important and popular branch of Ayurved developed in Medieval period. It deals with knowledge related with alchemy and Ayurvedic pharmaceuticals specially connected to the drugs of mineral origin to prevent mankind from ageing process. Concept of Rasashastra in ancient classical text book shows the inclination in the usage of parada was towards Datuvada and Dehavada, which gradually turned its importance in chikitsa. For the purpose of chikitsa the concept of murchana to Parada came into existence. Murchana is the most important process of Mercury in which Mercury is made to convert in such compound form

which must possess disease destroying property.^{1, 2} Under the concept of Murchana 4 forms medicines are explained, they are Parpati Rasayana, Potali Rasayana, Kharaliya Rasayana, Kupipakwa Rasayana. Among the 4 divisions, kupipakwa Rasayana is one which is prepared by using Gandhaka and without Gandhaka known as Sagandha and Nirgandha Respectively, Rasakarpura is one such Nirgandha variety of Kupipakwa Rasayana. Hence improper use of Rasakarpura will lead to Parada vikaras.^{3, 4} As per modern science it is considered as Mercuric or Mercurous chloride. Mercurous chloride because of its low solubility it is poorly absorbed and is regarded as safe medicine, but in large doses it acts as irritant poison and even in medicinal dosage it produces toxic effect in susceptible individuals in some cases death may also occurs.^{5, 6} Rasakarpura appears as a white sublimate with chemical composition of mercuric chloride. The artificially prepared Rasakarpura is commonly available in the market,

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prepared from metallic mercury, sulphuric acid and rock salt. This compound is widely used for many Ayurvedic preparations. It is also known as Mercury bi-chloride or Mercury per-chloride. It appears as crystals or white granules or as powder; in the toxicology field it has a nickname "violet poison." As there is lot of discussions existing in regard to Heavy metal Toxicity in recent days, so better to assess the Drug in terms of Physical, Chemical, Biological aspects, to provide scientific data and statistical validation for safety. Hence the study A Methodical Qualitative and Quantitative study of sublime "violet poison" w.s.r. to Rasakarpura was undertaken. The Analytical Study proved that Rasakarpura is a compound containing Mercuric Chloride as a main content along with some other trace elements and other parameters showed drug is suitable to body.

AIMS AND OBJECTIVES

- To study the organoleptic character, Physico-Chemical properties of Rasakarpura.
- To study qualitative and quantitative properties of Rasakarpura by following:
 - Particle Size Analysis
 - X-ray diffraction.
 - Elemental analysis.

MATERIALS AND METHODS

Organoleptic Characteristic Assessment

The drug is examined by means of the Sense Organs, and the difference in the drugs which are observable at a macroscopic level is appreciated. Organoleptic Characteristic Assessment of the drug Rasakarpura also confirmed by Ganesh consultancy and analytical services. These below mentioned tests were carried out in Ganesh consultancy and analytical services, Mysore.

- **Colour:** White.
- **Odour:** Characteristic.
- **Taste:** Palatable.
- **Appearance:** Crystalline.

Physico – Chemical Analysis:

- Determination of pH.
- Moisture Content (Loss on Drying).
- Total Ash,
- Acid Insoluble Ash,
- Water soluble Ash.

Determination of P^H value

Materials required: Digital P^H meter.

Applied aspect: To know the degree of acidity and alkalinity of the sample.

Procedure: 1 gm of sample mixed with 100 ml of distilled water, and the P^H reading was taken by using digital P^H meter.

Results

P^H of the sample Rasakarpura was: 7.24

Determination of Total Ash

Materials required:

- Muffle furnace,
- Silica crucible.
- Spatula.
- Deducator.
- Analytical balance.
- Rasa karpura.

Procedure

Incinerate the 2 g of accurately weighed & grounded drug in a tarred dish at a temperature not exceeding 450⁰c until free from carbon, cool & weighed (Gokhale, 2002 and Ayurvedic Pharmacopeia of India, 1985).^{8,9}

Result

The Percentage of total Ash value of Rasakarpura is 32.84%.

Determination of Acid Insoluble Ash

Materials required

- Muffle furnace,
- Silica crucible.
- Spatula.
- Deducator.
- Analytical balance.
- Dil HCl.

Applied aspect

Used to determine existing impurities in the given sample. It expresses the quality & purity of the given sample.

Procedure

The ash obtained after incinerating was boiled for 5 min with 25% of dilute HCl, collected the insoluble matter was collected in a on an ash less Filter Paper, and washed with hot water & ignited to constant weight then calculate the % age of acid insoluble ash with reference to the air dried drug (Gokhale, 2002 and Ayurvedic Pharmacopeia of India.).^{8,9}

Results

The Percentage of acid insoluble ash value of Rasakarpura is 18.13%

Determination of Water soluble Ash

Materials required

- Silica crucible
- Burner
- Ashless filter paper
- Electronic weighing Machine
- Distil Water – 100 ml

Applied aspect: To determine the amount of the water soluble percentage of the drug in a given sample.

Procedure: The ash obtained after incinerating was boiled for 5 min with 25% of dilute HCl, collected the insoluble matter was collected in a on an ash less Filter Paper, and washed with hot water & ignited for 15 minutes at a temperature not exceeding 450°. then Substraced the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water-soluble ash. The percentage of water-soluble ash with reference to the air-dried drug. The weight is then expressed in terms of %w/w (Gokhale, 2002 and Ayurvedic Pharmacopeia of India).^{8,9}

Results

The Percentage of water soluble ash value of Rasakarpura is 2.44%.

Determination on Loss on Drying (Moisture Content)

Materials required

- Hot air oven.
- Evaporating dishes.

Applied aspect

The moisture content of a drug should be minimized in order to prevent decomposition either due to chemical change or due to microbial contamination.

Procedure

1gm of the air-dried powder of drug was taken in a petri dish and weighed accurately. It is then placed in Electric oven at 110°C for 1 hour. After removing from oven it is allowed to cool down to room temperature in a desiccators and then weighed this was done repeatedly to constant weight (Gokhale, 2002 and Ayurvedic Pharmacopeia of India).^{8,9}

Results

The Percentage of loss on drying value of Rasakarpura is 3.25%.

Quantitative Analysis

Particle Size Determination

Definition: Particle Size determination can be defined as the estimation of average size of the particles, which are expressed in terms of number distribution and weight distribution.^{8,9}

Applied aspect: Particle size of the drug affects its absorption hence its determination can assess the rate of absorption. Determining the particle size of the material before and after processing helps to draw the conclusion regarding the significance of that particular pharmaceutical procedure.

Materials required

- Ocular micrometer,
- stage micro meter.
- microscope.

Result

Particle size of suspended solids in sample Rasakarpura: Minimum: 18 microns and Maximum: 31 microns.

Estimation of different elements: Estimation of different elements was carried out at Ganesh consultancy and analytical services, Mysore, Karnataka.¹⁰

Results

Mercury: 32.1%.

Arsenic: 1.70%.

Lead: 0.02%.

Crystallographic study by X-ray diffractometer

This test was carried out to identify elements present in the sample.

Principles

When a beam of X-radiation is incident upon a substance, the electrons constituting the atoms of the substances become as small oscillators. These oscillate at the same frequency as that of incident X-radiation. These scattered waves come from electrons which are arranged in a regular manner in a crystal lattice and then travel in certain directions. If these waves undergo constructive interference they are said to be diffracted by the crystal plane.

Every crystalline substance scatters the X-rays in its own unique diffraction pattern producing a finger print of its atomic and molecular structure. X-ray diffraction (XRD) patterns were obtained using a Shimadzu XRD-6000 diffractometer with Cu - K α as target with 40 KV voltages and 30 MA current. The X-ray diffraction of the sample was matched against the standard reference spectra library of software for phase identification (Dr.D.R.Lohar, 2008).¹⁰

Sl. No.	Parameters	Results
1	Colour	White
2	Odour	Characteristic
3	Taste	Paleatable
4	Appearance	Crystalline
5	pH Value	7.24
6	Total Ash	32.84 %
7	Acid insoluble ash	18.13 %
8	Water soluble ash	2.44 %
9	Loss on drying	3.25 %
10	Loss on ignition	7.25 %
11	Mercury	32.13 %
12	Arsenic	1.70 %
13	Lead	0.02 %
14	Particle size of suspended solids	
A	Minimum	18 Microns
B	Maximum	31 Microns

Figure 1. Organoleptic Characters

Angle 2-Theta °	d value Angstrom	Intensity %
20,364	4,35746	100,0
21,680	4,09592	25,4
24,856	3,57928	3,9
25,408	3,50274	2,3
26,369	3,37717	27,4
27,979	3,18645	9,7
29,071	3,06918	7,6
29,440	3,03157	15,5
29,923	2,98366	27,1
33,119	2,70266	17,9
37,236	2,41281	10,3
38,137	2,35783	3,2
39,257	2,29310	2,0
41,045	2,19724	3,9
41,378	2,18035	8,8
42,456	2,12742	13,3
43,873	2,06197	11,2
45,239	2,00279	8,4
46,813	1,93908	6,6
47,837	1,89994	5,2
49,598	1,83652	1,2
50,956	1,79071	6,5
51,586	1,77032	3,4
52,150	1,75248	2,0
54,604	1,67939	4,1
55,116	1,66500	3,1
55,678	1,64951	1,0
56,868	1,61778	3,3
57,751	1,59514	2,2
58,603	1,57394	1,3
60,182	1,53636	3,7
62,095	1,49356	1,6
62,912	1,47612	3,5
63,953	1,45457	4,2
65,253	1,42870	2,4
66,541	1,40414	2,8

Rasakarpura

Figure 2. Results & Inferences- Xr-D

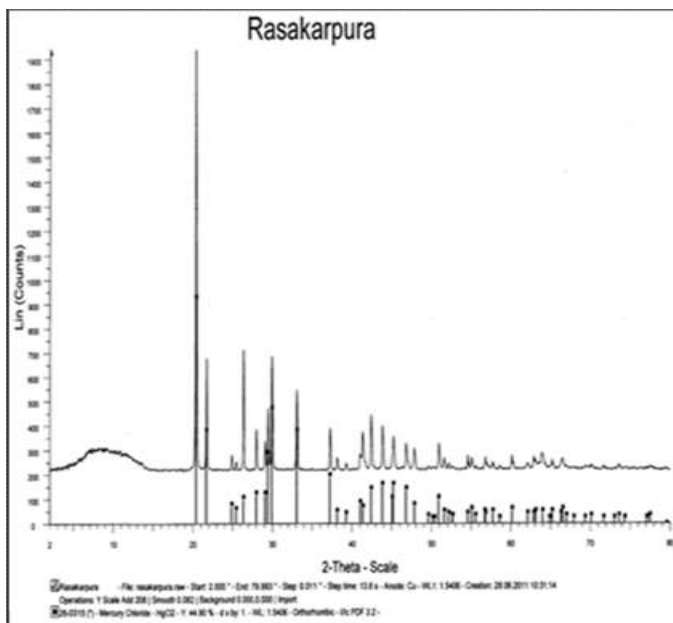


Figure 3. Xr-D Lin Counts

Results

The X-ray spectrum obtained was compared to the spectrum of Hg, HgCl₂, As, Pb, Na, Fe, and Mg for their presence. The tentative assignments were made to the intense peak appearing at various 2θ values. The intense peak at 2θ=20.364 (100%) indicates the presence of calcium. The prominent peak corresponds to HgCl₂ 24.86 and 26.37 indicate the presence of Hg as HgCl. And weak signals at 2θ=43.8 to 45.2 and the prominent at the 33.12 were assigned to the presence of Na. weak signals appearing at 2θ= 52.15 was assigned to Pb, a weak signal at 2θ=37.24 was assigned presence of Zn in traces. The peak corresponds to Hg at 2θ=23.0, 30 to 31.5, 34 and 36.0 were found missing but a very weak signals appear

2θ= 43.87, 52.15 with reduced intensity indicates the presence of traces of Fe and at 2θ=45.24.

Inference

X-ray diffraction study indicated the presence, HgCl₂, Ca Na, traces of Pb. Ar, Zn, Mg, Fe and almost absence of free Hg. The graphs obtained along with the result readings are attached further.

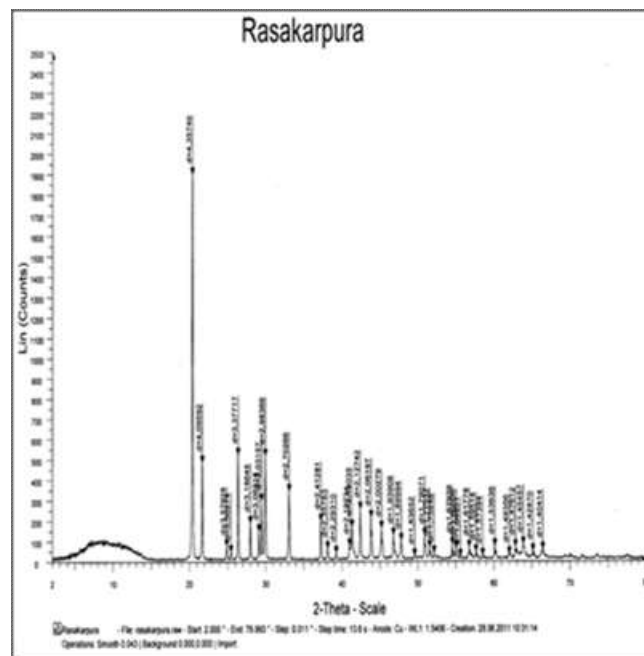


Figure 4. Xr-D Lin Counts

DISCUSSION

Analytical study brings the standard parameters for the good quality drug. Physicochemical data of the drug help to know how the drug acts in the body. The pH of the sample of Rasakarpura is 7.24 the P^H of the sample if found to be more nearer to neutral side, normally the drug to be administered should not be either too Acidic or much Alkaline in nature but should be maintained around neutral. The ash value helps us to determine the amount of inorganic substances present in the sample. The value was found to be very less that is 32.84% as a drug is totally inorganic in nature ash value should be more, but this compound containing volatile materials like mercury, sulphur, arsenic and chlorine are will not be stable at the temperature of 450⁰ C. The percentage of acid insoluble ash value was 18.13% Acid insoluble ash is the residue obtained after boiling the total ash with dil. HCl and igniting the remaining insoluble matter, this measures the amount of silica present especially as sand and siliceous earth. The percentage of water soluble ash value was 2.44%, Water soluble ash is difference in between total ash and residue after treatment of total ash with water. The Moisture content of the samples helps to identify the stability of the drug. Lower its value the more stable drug would be. The Particle size of the sample varies from 18 microns to 31 microns, lesser the particle size-better absorption in the body. The size of the particle is influenced by the kind of heat given, pressure applied for powdering & the filter medium used during the pharmaceutical process. Elemental analysis indicates presence of Mercury with some trace elements. X-ray diffraction study indicated the

presence, HgCl₂, Ca, Na, traces of Pb, Ar, Zn, Mg, Fe and almost absence of free Hg.

CONCLUSION

Rasakarpura is white colour, crystalline, structure with characteristic odour, PH of Rasakarpura is 7.24, Particle size Rasakarpura is 18 micron to 31 micron which facilitate better absorption in body. X-RD Reveals presence of HgCl₂ as a main constituent along with other Trace elements

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