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Analytical Study of *Kapardika Bhasma* Prepared According to *Rasa Tarangini*

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ABSTRACT

Bhasmas are unique *ayurvedic* metallic/mineral preparations which are biologically produced nanoparticles which are mainly prescribed along with other medicines of *Ayurveda. Kapardika* (cowries/marine shell) is a mineral drug which is mentioned in *Ayurveda* classics. *Kapardika* is one of the important drugs used in *Ayurveda* in the form of *bhasma*. *Kapardika bhasma* which is prepared by treating with juice of *Kumari* (aloe vera) made it into pellets and subjected to certain quantum of heat as per *Puta*. *Kapardika bhasma* is an important ingredient of many *ayurvedic* formulations.

The article is based on *Shodhana* of *Kapardika*, *Marana* of *Kapardika* followed by analytical study carried out by classical *Bhasma pareeksha*, organoleptic characteristics, selected physico-chemical parameters, and advanced instrumental methods like XRD, DLS and SEM. After analysis it is observed that *Kapardika bhasma* looked white with a smooth touch, non-specific odour, and alkaline taste. Qualitative analysis showed the presence of calcium. .The major peaks observed clearly indicate calcite as the major phase (calcium carbonate with hexagonal structure under trigonal crystal system). *Kapardika bhasma* showed a crystallite size 72.70nm. SEM- EDAX showed the presence of Calcite crystals with hexagonal shape having size of 1.022 microns. In *Kapardika bhasma*90% particles size are observed about 472.1nm.

KEYWORDS

Kapardika bhasma, Bhasma pareeksha, XRD,Physico- Chemical Analysis

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INTRODUCTION

Bhasmas are the unique *ayurvedic* metallic/mineral formulations which are mainly administere dalong with other medicines of *Ayurveda* to impart avery good therapeutic efficacy. Properly prepared *Bhasma* must be readily absorbable, adaptable and as similable in the body and will be nontoxic. *Bhasma* increases metabolism at cellular level and acts as catalyst. These attributes of *Bhasma* are comparable with the action of Nano particles in the body. These are biodegradable, biocompatible and non-antigenic in nature.

Kapardika (Cypraea moneta Linn.) is the fourth mineral drug under *Sadharana rasa* group and also under *Sudhavargeeya dravyas*[1]. It is identified as 'marine shell,' 'cowry' or as 'cowrie' in English. Cowrie is the common name given for a group of small to large sea shells, marine gastropod molluscs in the family cypraeidae, the cowries.

Kapardika Bhasma is an important constituent of many *Ayurvedic* formulations. It is mainly indicated in conditions like *Agnimandya, Grahani roga, kshaya roga, Karnasrava, Netraroga,* and also in all types of *udara shula*[2].

AIMS & OBJECTIVES

- To perform *shodhana* and *maarana* of *Kapardika bhasma*.
- To carry out detailed Physico-chemical analysis of *Kapardika Bhasma*for knowing structure, elements present and particle size.

MATERIALS & METHODS

Cowries i.e. *Kapardika*were procured from the local market of Udupi. *Shodhana* (purification) and *Maarana* (incineration) of *Kapardika* were carried out accordance to classical reference in pharmacy of Muniyal Institute of Ayurveda Medical Sciences; Manipal and Analytical study was carried out in Quality control laboratory of M.I.A.M.S, Manipal, Karnataka.

Preparation of *kulattha kwatha*

1kg of *Kulattha* seed (Horse gram) was added with 8litres of water and boiled on moderate heat and reduced to 1/4th i.e. resulting in 2 litres of *kulattha kwatha* and it was used for the *shodhana* of *Kapardika*[3].

Kapardika Shodhana

Ingredients:

1)*Kapardika -300g*

2)*Kulattha kwatha*- 2litres

Apparartus required: L.P.G Stove, Stainless steel vessels, Match box, Cloth

Procedure:

300g of *Kapardika* was taken in a cloth and tied in the form of *pottali*. *Shodhana* was carried out heating in *Dolayantra* using *Kulatha kwatha* as liquid medium. *Swedana* was done for 3 hrs on moderate heat[4].

Observations:

Physical impurities like clay, sand etc. got separated from *Kapardika.*

Final weight obtained: 270g

Kapardika Marana

For the incineration process about 280 g of *Shuddha Kapardika* was taken. The *Shuddha Kapardika* was placed in a *Sharava* and done proper *Sandhi bandhana*. Then it was subjected to one *Gaja Puta*. After *Swanga sheetha* it was collected and powdered for further *Gajaputa*[5].

Ingredients:

1. *Shuddha Kapardika* -270g
2. *Kumari swarasa*-200ml

Procedure:

Powdered *Kapardika* 270g was triturated with *Kumari swarasa* in *khalwa yantra* for 3hrs manually. After *subhavitha lakshanas* were seen, uniform size *chakrikas* (pellets) were made. They were shade dried and placed in *sharava*. After proper sealing, they were subjected for second *puta* .Total three *puta* were given for *Shuddha Kapardika*. The results are shown in Table1.

Table 1 Observations during incineration of *Kapardika bhasma*

No.of Puta	**1st**	**2nd**	**3rd**
Quantity of *Shuddha Kapardika* Used	270g	250g	200g
Quantity of *Kumari swarasa* used	-	200ml	150ml
Duration of Trituration	-	3 hrs	3 hrs
Total no.of *chakrika* prepared	-	40	35
Total weight of *Chakrika* dried up	-	230g	190g
Amount of *Upalas* used	21kg	21kg	21kg
Final product obtained	-	-	180g

ANALYTICAL STUDY

1) ***Bhasma pareeksha***

a.*Varitaratva*[6]

b. *Rekhapurnata*

2) Organoleptic parameters

a.Colour

b. Odour

c. Taste

d. Touch

The results are shown in Table 2.

Table 2 Organoleptic parameters of *Kapardika bhasma*

Organoleptic parameter	***Kapardika Bhasma***
Colour	White
Taste	Alkaline
Touch	Smooth
Odour	Not specific
Shabdha (Dante kachakachaabhava)	No gritty sound felt.

3) Physico – Chemical parameters[7]

a. pH value

b. Loss on drying

c. Total Ash

d. Acid insoluble ash

The results are shown in Table 3.

Table 3 Physico-chemical analysis of *Kapardika bhasma*

Sr.No.	Parameters	*Kapardika Bhasma*
1	LOD (Loss on Drying)	0.55%
2	Total ash	85.50% w/w
3	Acid insoluble ash	58.26% w/w
4	pH	11.26

4)Qualitative study of *Kapardika Bhasma*

5)X-Ray Diffraction (XRD) for major phase identification[8]

6)Scanning Electron Microscope (SEM) [9]

7)Particle size analysis by Dynamic Light Scattering Method (DLS) [10]

1. BHASMA PAREEKSHA

i)Varitara Test:

Water was taken in a plastic jar and allows for stagnation .Then small amount of *Bhasma* was taken in between index finger and thumb and pressed to form a small flat mass and that was slowly kept on the surface of stagnant water in jar from a short distance and observed.

ii)Unama Test:

If grains are put over the floating sample of the Bhasma it should continue its floating.

iii)Rekhapurnata Test:

Very little amount of *Bhasma* was taken in between thumb and index finger and rubbed and observed whether the *Bhasma* fills the furrows of the fingertip or not.

The results are shown in Table 4.

Table 4 Bhasma pareeksha for Kapardika bhasma

Organoleptic parameter	*Kapardika Bhasma*
Rekhapurnata	Positive
Varitartwa	Negative(as hygroscopic)
Unama	Negative

QUALITATIVE STUDY OF CALCIUM

Detection of calcium-

Pinch of *Kapardikabhasma* was dissolved in dil. HCl and filtered, then to this filtered solution 1 drop of dil. Ammonium Hydroxide and Saturated Ammonium Oxalate solution were added, white precipitation of Calcium Oxalate was formed. Precipitation was soluble in HCl but was insoluble in acetic acid indicates the presence of calcium.

X – RAY DIFFRACTION

X – Ray Diffraction has been use for the fingerprint characterization of crystalline materials and the determination of their structure.XRD patterns were obtained using a Shimadzu XRD-6000 diffrac to meter with Cu K-α as target with 40 kV voltages and 30 mA current. The crystallinity *Kapardika Bhasma* was analyzed using an X-Ray diffract to meter at NIO, Goa by irradiating with Cu – Kα radiation (at 1.54060Å). The analysis was performed from 20.0 to 80.0(°2Th) with a step size of 0.2(°2Th). Gonio meter with

the radius 240 mm having a minimum step size of 0.001(°2Th) was used. The X-ray diffraction of the *Kapardika bhasma* was matched against the standard reference spectra library of software for phase identification.

The results are shown in Table 5 and figure 1.

Table 5 XRD peak list for *Kapardika bhasma*

Peak no.	Pos.(^{0}2Th.)	FWHM Left (^{0}2Th.)	d-Spacing A^0	Rel. int. (%)	I/Io
1	23.020	0.165	3.8603	366	10
2	29.380	0.118	3.0375	4028	100
3	31.400	0.118	2.8466	246	7
4	34.040	0.141	2.6316	123	4
5	35.940	0.141	2.4967	368	10
6	39.380	0.141	2.2862	500	13
7	43.140	0.118	2.0952	506	13
8	47.480	0.094	1.9133	777	20
9	48.480	0.118	1.8762	581	15
10	56.540	0.094	1.6263	93	3
11	57.380	0.094	1.6045	189	5
12	58.060	0.165	1.5873	94	3

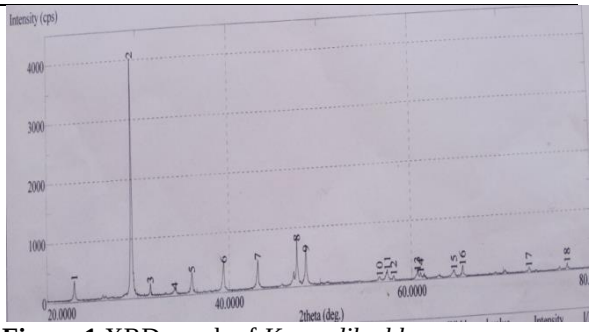

Figure 1 XRD graph of *Kapardika bhasma*

SCANNING ELECTRON MICROSCOPE (SEM)

The scanning electron microscope is a type of electron microscope that images the sample surface by scanning it with a high-energy beam of electrons in a raster scan pattern. The electrons interact with the atoms producing signals. This signal gives information about the sample's surface topography, composition and other properties such as electrical conductivity.

The surface morphology *Kapardika bhasma* was qualitatively assessed using a cold field emission scanning electron microscope (JSM-6380, JEOL). The sample was mounted on a brass stub and sputter coated with platinum and introduced into the specimen chamber. Imaging was carried out at an acceleration voltage of 20 keV.

The result is shown in Figure 2.

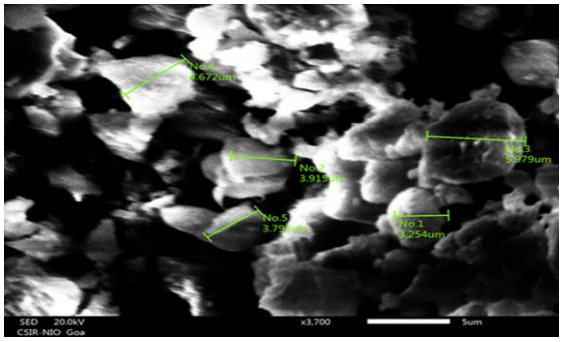

Figure 2 SEM image of *Kapardika bhasma*

DYNAMIC LIGHT SCATTERING (DLS)

Dynamic light scattering (DLS) is a non-invasive, well-established technique for measuring the size of molecules and particles typically in the sub-micron region, and with the latest technology

lower than 1 nanometer. To determine the mean particle size, the *Kapardika bhasma* was analyzed by dynamic light scattering by using zeta sizer, supplied by Malvern instruments Ltd. Water was used as a dispersant and the study was carried out at a temperature of 250°C. Measurement position is 5.50 mm and the count rate is 213.4 kcps. Clear disposable zeta cell was used to carry out the study.

The results are shown in Table 6.

Table 6 Size distribution for *Kapardika Bhasma*

Peak No.	S.P. Area Ratio	Mean	S.D	Mode
1	1.00	536.3 nm	22.8nm	539.9nm
2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00
Total	1.00	536.3nm	22.8nm	539.9nm

DISCUSSION

Kapardika Bhasma is analyzed with classical *Bhasma pareeksha*, organoleptic characteristics, selected physico-chemical parameters, and advanced instrumental methods like XRD, DLS and SEM. The colour of *Kapardika bhasma* is white with a smooth touch, non-specific odour, and alkaline taste. Alkalinity is due to high pH of the product. When chewed did not produce any gritty feeling which further ensures the fineness of the particles.

As *Kapardika bhasma* is *Sudhavargeeya bhasma* and non-metallic in nature, tests like *apunarbhav, niruttha* are not carried out. All the samples are fine and smooth confirming the *sukshmatva*. When rubbed between thumb and fore finger majority of *bhasma* particles filled the finger creases confirming *rekhapurnata* of *bhasma*. *Kapardika bhasma* is hygroscopic and has surface wetting properties even though floats momentarily it sinks and hence both *varitartva* and *unama* tests are negative which is true for all *Sudhavargeeya bhasmas*[11].

Moisture content is low with 0.55% indicating better stability. Total ash value is very high with 85.50%w/w. Product itself in ash form and has high amount of calcium as an inorganic component apart from the traces of other minerals. Acid insoluble ash value is quite high with 58.26% w/w. *Kapardika bhasma* showed an alkaline pH with average of 11.26 which is suitable for the treatment of acid peptic disorders. *Kapardika* showed the presence of calcium in qualitative analysis.

X-Ray Diffraction is a versatile non-destructive technique that reveals detailed information about chemical composition and crystallographic structures of natural and synthetic materials. XRD is a powerful tool for detecting the presence of various phases in the given sample. Here XRD of powder sample of *Kapardika bhasma* is carried out by irradiating with Cu-Kα radiation at 1.54060 θ Å, obtained XRD

graphs and values are carefully evaluated. The major peaks observed in sample clearly indicate calcite as the major phase (calcium carbonate with hexagonal structure under trigonal crystal system).Major peak with 100% relative intensity is a peak with position 29.380 º 2θ, FWHM 0.118 and d-spacing 3.0375Å. A crystallite size of major compound is calculated based on the major peak, *Kapardika bhasma* showed a crystallite size 72.70nm[12].

An electron microscope is a type of microscope that uses particle beam of electrons to illuminate a specimen and create highly magnified image. This study is carried out by using a cold field scanning electron microscope. Image is taken at magnification of 3700X. Calcite crystals with hexagonal shape are found scattered. Smallest one recorded has size of 1.022 microns. Higher resolution could have revealed nano particles.

Dynamic light scattering method is used to analyze particle size distribution. Scanning electron microscopes have limitations as it considers the particles only at the area of focus. DLS have an advantage that it takes into account all the particles in sample subjected for analysis. 90% of particles are of about 472.1nm. 10% are an average of 491.7nm.

CONCLUSION

Kapardika bhasma is an important constituent of many *Ayurveda* formulations. It is mainly indicated in acid peptic disorders due to its alkaline nature and antacid property. Fine, smooth and nano particle size of *Kapardika bhasma* helps in better absorption and easy assimilation in human body. Hence through *bhasma pareeksha* and with help of modern analytical techniques it can be said that classically prepared *Kapardika bhasma* is very safe for therapeutic use and efficacious for internal administration.

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