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Comparative Physio-Chemical Evaluation of Different Brands of Lauha Bhasmas

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Abstract

Objectives: Rasashastra is a subject which deals with metals and its therapeutic effect. It mentions the use of metals in a refined form as bhasma. Lauha is used extensively in the Ayurvedic literature for the management of various diseases like Pandu (Anemia), Shotha (Oedema), Kamala (Jaundice) etc. It is very hard metal hence it should be made into bhasma for using it for medicinal purposes. During storage of the formulation no of physical or chemical changes may occur which may affect efficacy of Lauha Bhasma. Pharmaceutical and analytical studies were conducted during the storage conditions of the Lauha bhasma to know the changes in the chemical composition at various stages. The present work was conducted to establish the quality aspects of the use of Lauha bhasma.

Methods: But to make the bhasma globally acceptable some of the modern parameters adapted to evaluation such as organoleptic evaluations, physical evaluations (Loss on drying, Ash value, Acid insoluble ash, Ash value extractive, Phytochemical screening by TLC), chemical evaluations (Qualitative determination of metals such as Sodium, Iron & Potassium). We purchased two well established brands of Lauha bhasma from India and subjected to above mentioned evaluations in laboratory using standard official procedures.

Results: Result showed that brand A was found complying LOD (0.39% w/w), Total ash (0.93%), Acid insoluble ash (103.08%), Alcohol soluble ash (17%), Water soluble ash (20%), Phytochemical TLC screening Rf 0.5 with color Yellow, Qualitative metal Iron present and quantitative Iron as Fe_2O_3 95.578% with Iron as Fe 73.211% standard set as per Indian Ayurvedic Pharmacopeia. But other brand B was found LOD (0.43% w/w), Total ash (0.72%), Acid insoluble ash (115.06%), Alcohol soluble ash (15%), Water soluble ash (18%), Phytochemical TLC screening Rf 0.22 with color Purple, Qualitative metal Iron present and quantitative Iron as Fe_2O_3 82.245% with Iron as Fe 60.205%.

Conclusion: So, our study suggests that brand B total ash value less revels less care taken during its preparation as compared to brand A. Higher limit of acid insoluble ash of brand B revels that silica presence or calcium oxalate content of drug is very high. As per our observation sample A product as per quality control parameters more reliable and may be more effective to patients.

Keywords: Loha bhasma; Ayurveda; Shodhan; Calcination; Muffle furnace; India; Herbo-mineral

Introduction

Lauha Bhasma (LB) is a complex herbo-mineral preparation widely used as an Ayurvedic hematinic agent. It is an effective remedy for chronic fever (*Jīrṇa jvara*), phthisis (*Kṣaya*), breathlessness (*Svāsa*) etc., and possesses vitality enhancing (*Vājīkara*), strength promoting and anti-aging (*Rasāyana*) properties [1]. Ayurveda is thousands of years old holistic system of Indian medicine. In the Ayurvedic description, several metallic preparations called Bhasma are clinical use since 8th century AD. The Puta system of Ayurveda describes that metals or minerals should be heated at high temperature for melting and then it quench in suitable media like herbal juices or decoction for specified times [2]. The Bhasma (incinerated metals) is obtained by repeating these methods several times. In this process the toxic effects of the metals are not only nullified but are transformed into biological active nanoparticles [3]. When various Bhasma viz. Sanka bhasma, Makshika bhasma, Abharak bhasma, Jasad bhasma and Louha bhasma were subjected to analysis under electron microscope it was found that they were similar to nanocrystalline materials possessing similar physio-chemical properties [3]. The therapeutic effect of Bhasma may be attributed to large surface area of materials and small particles size by which they can easily transported into the cell nucleus and to specific target sites as desired. So, this comparative analysis gives the comprehensive physio-chemicals evaluation of some different brands of Bhasmas [4].

Bhasma in Ayurveda has been defined as a substance obtained by calcination. Use of both bhasma (Residue after

incineration-calcined preparation) as well as in pishti (powdered gem or metal) form along with appropriate herbs for treatment of critical ailments is a medicinal preparation in Ayurveda and to some extent Unani (both Indian branches of medical science using natural curative methods. The procedures for preparing these medicines are time-consuming and complicated. Bhasma is a calcined preparation in which the gem or metal is converted into ash. Gems or metals are purified to remove impurities and treated by triturating and macerating in herbal extracts. The dough so obtained is calcinated to obtain the ashes [5].

Importance of bhasma

The practitioners of Ayurveda had wisdom to realize the importance of key metallic elements required in ensuring proper functioning of physiological systems. They had mastered the art of administering these elements in non-toxic, absorbable form through a series of meticulous physicochemical transformations achieved using various herbal and animal products.

Lauha bhasma is widely used for the treatment of anemia, hyperlipidemia, tuberculosis, urinary tract infections, obesity, and so forth. The preparation involves samanya shodana (general purification step), vishesha shodana (special purification step), Bhanupaka (reaction under sunlight), sthalipaka (roasting of contents in iron vessel), and puta (calcination). These steps are believed to have a strong scientific basis. However, these have not been properly documented leading to quality control issues during the manufacturing process. Thus, the scientific rationale in the preparation of Lauha bhasma needs to be explored and validated [6].

Materials and Methods

We purchased two famous brands of Loha bhasma from local market and given coding to them as A and B code named for non-disclosures of company names in research paper.

Organoleptic evaluations

Both samples were subjected to organoleptic evaluations using standard procedure as per method recommended in Pharmacopoeia of India, Samples were observed and noted observations about color, taste, size, extra features for both samples individually. Both samples were subjected to check solubility in dilute acidic solutions, and organic solvents for determining solubility parameters [7].

Physical evaluations

Both samples were subjected to following process of proximate analysis:

Loss on drying (LOD): Weighed about 2 g the powered drug into a weighed flat and thin nickel or silica tared crucible. After that subjected for drying for two hours in the oven at 100°C or 110°C till a constant weight was obtained. The percentage difference in two weights gives loss on drying [8].

Ash value: Ash values are helpful to determine quality as well as purity of crude drugs, especially when drugs are present in powder form. Accurately weighed 2 gm quantity of each sample separately in tare platinum or silica crucibles was placed in Muffle furnace (Digiqual Chennai) by gradually increasing the heat continued till red hot of silica crucible at 400°C about for two hours. We continued this process till obtained two constant weights. The percentage difference in two weights gives value for total ash.

Acid insoluble ash: Fifty percent of total ash amount was taken separately and boiled with 25 ml of Dilute Hydrochloric acid solution in conical flask on water bath. After cooling at room temperature filtered through Whatman previously tare filter paper and weighed after drying once again at room temperature. Difference between initial and final weights we put in to formula for calculation of percentage for insoluble ash with reference to air dried samples.

Ash value extractive: To obtain extractive ash values by extracting both samples separately were indicative of approximate measures of their chemical constituents taking into consideration the diversity in chemical nature in properties of drug. Various solvent was used for determination of extractive which were as follows:

Alcohol soluble extractives and Chloroform soluble extractives: Accurately weighed 2 gm samples of both companies were subjected to maceration process for 24 hours with intermittent shaking the conical flask with both organic solvents separately. Then flasks were allowed to recover in distillation unit till complete removal of solvent from extracts. Further dried in desiccator to obtain solid substances [9].

Phytochemical screening: TLC of both samples was carried out using solvent system Toluene:ethyl acetate (7:3) ratio. Plates were sprayed with Vanillin Sulphuric acid as detecting reagent to obtain spots after that Rf values were calculated for both samples [10].

Chemical evaluations: Both samples were subjected to metal ion tests as follows [11].

Table 1 Tests for metals.

S No	Tests	Observation	Inference
1	Test for Sodium Na Flame test: Prepared thick paste of ash with Conc HCl and this paste were taken on platinum wire. Placed this wire in Bunsen burner.	Golden yellow flame	Sodium confirm
2	10 ml ash extract+2 ml of potassium pyroanthllollate solution.	White precipitate	Sodium confirm
3	2 ml test solution was added with little Uranyl magnesium acetate reagent. Shake well and keep for few minutes.	Yellow crystalline precipitate	Sodium confirm

4	Test for iron (Fe) To 5 ml test solution added few drops 2% potassium Ferro cyanide.	Dark blue color	Iron Fe confirm
5	Test for Potassium: Flame test burned the sample in flame	Violet colored flame	Potassium confirm
6	To 2-3 ml of test solution, added few drops sodium cobalt nitrite solution.	Yellow precipitate	Potassium confirm

Qualitative determinations of metal in Bhasma: Both samples were subjected to following tests for qualitative determinations for metals presence (**Table 1**).

Iron as Fe_2O_3: Fired the three silica crucibles till constant weight with accurately weighed 0.5 gm of samples separately, allowed to cool at room temperature. Each sample was dissolved in sufficient quantity of 3 M HCl if needed filter the samples. In that 5 ml of 6 M HNO_3 and boiled for two minutes. After that samples were diluted to 200 ml with distilled water and basified with 3 M Ammonia solution till basic nature. Resultant solution boiled for five minutes and supernatant decanted with ash less filter paper. Washed the solid with 1% $NHNO_3$ until chlorine was detected. Filter paper was allowed to dry for at least 24 hours protected from dust. Sample was dried and filter paper was ignited at 900°C in muffle furnace. Upon cooling solid was weighed and repeat the procedure till two constant results were obtained. Readings obtained added in formula for % Yield of Iron as Fe_2O_3 calculated with help of formula. For calculation of Iron % in each samples gm of Fe as product divided by grams of reactant multiplied by 100 gives quantity as Iron % in respective samples [12].

Results and Discussion

The organoleptic evaluations revealed that no any changes in both sample colour, odour, taste and extra feature except micro fine nature in sample A indicates perfect size reduction and more surface area for absorption in patient body as shown in **Table 2**.

Table 2 Organoleptic evaluation results.

Sample No	Color	Odour	Taste	Shape/ Size	Extra feature
A	Dark brown	Characteristics	Biter and nauseating	Micro fine nature	Metallic luster
B	Brownish black	Strong and characteristics	Bitter	Fine in nature	Metallic luster

In case of solubility determinations both samples were found soluble in Water, Alcohol and Chloroform only as shown in **Table 3**.

In physical evaluations indicate the more values for sample B in LOD (0.43), Acid insoluble ash (115.06%) as compared to sample A indicates presence of inbuilt moisture and higher limit of acid insoluble ash of brand B revels that silica presence or calcium oxalate content of drug is very high as shown in **Table 3**.

Table 3 Solubility results.

S NO	Solvents	Observation A	Observation B
1	Water	+	+
2	Alcohol	+	+
3	Acetone	-	-
4	Chloroform	+	+
5	Dilute hydrochloric acid	-	-
6	Dilute sulphuric acid	-	-

Phytochemical evaluations by TLC revealed that in brand A spot Rf 0.5 with yellow color more developed as compared to sample B Rf 0.22 (purple) due to some alteration needed in solvent system toward high polarity as shown in **Table 4**. Both sample different color indicating that different phytoconstituents due to source changes.

Table 4 Showing results of physical evaluations.

S No	Name of analysis	Percentage w/w	
1	Samples	A	B
	Loss on drying	0.39 gm	0.43 gm
2	**Ash value**		
	A) Total Ash value	0.93%	0.72%
	B) Acid insoluble ash value	103.08%	115.06%
3	**Extractive value**		
	A) Alcohol soluble	17%	15%
	B) Water soluble.	20%	18%

Table 5 Phytochemical screening results showing only two spots.

S No	Samples	Rf Value	Color of Spots
1	A	0.5	Yellow
2	B	0.22	Purple

Table 6 Chemical analysis (Qualitative).

S No	Samples	Test for Sodium (Na)	Test for Iron (Fe)	Test for Potassium (K)
1	A	-	+	-
2	B	-	+	-

A chemical test indicates the presence of Sodium, Potassium, and Iron qualitatively in both brand samples. But quantitatively iron as Fe_2O_3 and Fe was much higher in brand A (65.578 and 73.211%). But less value Fe_2O_3 and Fe (82.245

and 60.205) indicating some poor formulation of brand B as shown in **Tables 5-7**.

Table 7 Chemical analysis (Quantitative).

S No	Samples	Iron as Fe_2O_3	Iron as Fe
1	A	95.58%	73.21%
2	B	82.25%	60.21%

Conclusion

So, our study suggests that brand B total ash value less revels the care taken during its preparation as compared to brand A. Higher limit of acid insoluble ash of brand B revels that silica presence or calcium oxalate content of drug is very high. As per our observation sample A product as per quality control parameters more reliable and may be more effective in patients. Sample of A-brand was found very close to standard as per Ayurvedic pharmacopeias.

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