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Chemical and Structural Analysis of Ayurvedic Preparation: *Swarna Bhasma*

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Abstract

Swarna bhasma is being used in different therapeutic treatments. Yet the awareness of the immense potential of this remedy is not adequate. This requires scientific experimental proofs which will help better understanding and acceptance of this alternative stream of medicines. Appropriate design of experiments to prove the efficacy of Ayurvedic *Swarna bhasma* is the main objective of this study. In current study we have performed chemical and structural characterization of branded (standard composition of) *Swarna bhasma*. The Energy Dispersive X-ray Spectrometry (EDS) showed almost 27% of Arsenic in the composition. This could either lead to direct cytotoxicity or according to some research papers to the anticancer pathway. The antioxidant activity of *Swarna bhasma* is found to be comparable to that of standard green tea extracts. This explains probable mechanism of *Swarna bhasma* in DNA repair i.e., by scavenging reactive oxygen species and restoring the oxidative damages in DNA.

Keywords

Swarna Bhasma, Characterization, Arsenic, Antioxidant, Reactive Oxygen Species

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INTRODUCTION

Ayurvedic *Bhasmas* are one of the most under-rated techniques in the field of medicine. Lack of experimental evidence for efficacy of these *bhasmas* on micro-organisms as well as human cells/ tissues causes a big issue in acceptance of these *bhasmas* by the society. Considering the huge potential of *bhasmas* in therapeutics, it is very essential to design scientifically correct experiments to prove their worth. These *bhasmas* are essentially, calcinated form of different elements such as iron, copper, gold, aluminum, and mercury, etc. These ayurvedic *bhasmas* are prepared using various herbal extract along with the elements[1]. These herbal juices are known to impart certain qualities to the elements along the long preparatory process. It takes 3-5 months to prepare any pure *bhasma* according to traditional methods[1,2]. Each step in this process is very detailed and important for the therapeutic qualities of the final product. The end product obtained is usually in nano-scale[2].

Swarna bhasma is one of the most widely known *bhasmas*. It is used in various diseases. Main condition treated by *Swarna bhasma* is weak immunity[1]. Recently, many immunity enhancing products such as Chavanprash include *Swarna bhasma*. Slowly people are seeing the positive results and are accepting the basics of *bhasmas*. Along with immunity booster *Swarna bhasma* also acts as cardiac stimulant, aphrodisiac, etc. Many diseases including tuberculosis, diabetes and certain types of cancers are treated using *Swarna bhasmas*[1]. In many cases, these ayurvedic bhasmas are coupled along with allopathic medicines for better results[3].

Here in the current study, we have tried to give scientific basis for the efficacy of *Swarna bhasma*. Chemical and structural properties of *Swarna bhasma* are experimentally proven in this study. The main aim of this work is to build a foundation for finding probable mechanisms of action of *Swarna bhasma* against micro-organisms and other diseases.

MATERIALS AND METHODS

All the tests were performed on standard pure *Swarna bhasma* composition available under renowned brand name in the market.

Determination of microbial load on the *Swarna bhasma* using agar plates[10]

Serial dilutions of *Swarna bhasma* up to 10^{-6} were set up using nutrient broth. After incubation for 48 and 96h at 37°C, the

dilutions were plated on Czapec-Dox agar to check fungal colonies and on a plate with total plate count agar to check bacterial colonies.

Determination of inhibitory action of *Swarna bhasma* on microbes[10]

These inhibitory tests were performed on 4 micro-organisms viz. *B. cereus, E. coli, S. aureus, P. aeruginosa.* The inhibitory action of *Swarna bhasma* was determined at low as well as high concentrations of *Swarna bhasma*. For low concentration assay, the bacterial cultures were spread on nutrient agar plates: 1 culture on each plate. Each of these plates was then inoculated with a loopful of *Swarna bhasma* inoculums. The *Swarna bhasma* inoculum was prepared by adding 0.1 ml of Tween80 and 9.9 ml of sterile saline water to 10 mg of *Swarna bhasma*. For high concentration assay, broth dilution method was used[4]. Here 1mg, 2mg, 4mg and 8 mg *Swarna bhasma* was taken 4 sterile tubes (4 sets for 4 different microorganisms). Each of these tubes was added with 0.1 ml of overnight bacterial culture. Then the tubes were incubated at 37^{o}C for 24h. Turbidity was observed after incubation period.

Determination of total ash content

Total ash content of the *Swarna bhasma* was determined using standard gravimetric procedure.(APHA, 1985)

Determination of antioxidant activity of *Swarna bhasma*

Antioxidant activity of *Swarna bhasma* was determined using standard protocol of DPPH assay[6].

Field Emission Scanning Electron Microscopy (FESEM)[8]

To study the surface structure of the *Swarna bhasma* nanoparticles FESEM analysis was carried out on FEI Nova NanoSEM 450. Resolution: 1.0 nm at 15kV, 1.4 nm at 1kV and 1.8 nm at 3kV and 30Pa.Software used was xT microscope control. Sputter coated with C. FESEM facilities at Central Instrumentation facility, Savitribai Phule Pune University were used.

Energy Dispersive X-ray Spectrometry (EDS)[8]

Elemental composition of the *Swarna bhasma* was determined by EDS analysis. It was carried out on Bruker X Flash 6I30. Resolution: 123eVat Mn k-alpha and 45eV at C K-alpha and element detection range from ^{4} Be to ^{95} Am . Software used was Espirit 1.9. EDS facilities at Central Instrumentation facility, Savitribai Phule Pune University were used.

X-Ray Diffraction (XRD)[8]

The elemental composition of the *Swarna bhasma* was confirmed used XRD analysis. The XRD facilities at chemistry department of Savitribai Phule Pune University were used.

RESULTS AND DISCUSSION

Czapec-Dox agar plates as well as total plate count agar plates did not show any growth of micro-organisms even after 96h of incubation. The nil microbial load of the *Swarna bhasma* indicated that it is microbicidal.

At low concentrations the *Swarna bhasma* showed no inhibitory action on the microbes, no zone of inhibition was observed. In case of high concentration, at each concentration of the *Swarna bhasma* all 4 micro-orgasms were inhibited. According to the standard dosages specified in the literature, low concentrations should show the expected inhibitory action yet the results are negative, this suggests that probably, the main aim of *Swarna bhasma* is not killing the microbe but could be the control of micro-organisms.

The total ash content of the *Swarna bhasma* sample determined by gravimetric method was 2.7% which was fairly high which may be helpful for digestive tract.

The antioxidant activity of the *Swarna bhasma* determined by DPPH method was 58.72% at 0.1mg/ml concentration. There are no reports regarding the antioxidant activity of *Swarna bhasma*. This percentage is comparable to the antioxidant studies of green tea extracts[7]. This is one of the important properties of bhasmas. It shows potential of *Swarna bhasma* against the oxidative damage of DNA. This is one of the possibilities in which *Swarna bhasma* actually acts on host cell DNA for repairing it in case of diseased conditions[6].

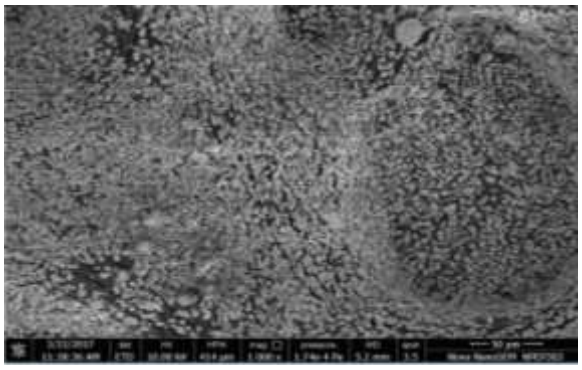


Fig 1a : FESEM image at 1000x Magnification

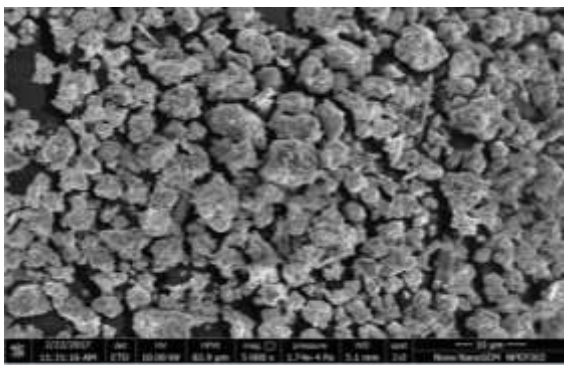


Fig 1b : FESEM image at 5000x Magnification

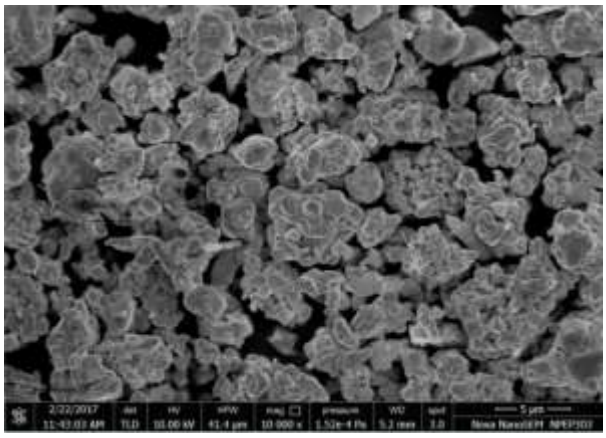


Fig 1c : FESEM image at 10000x Magnification

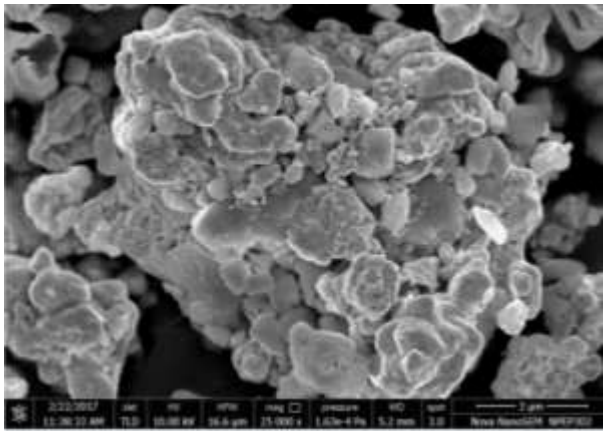
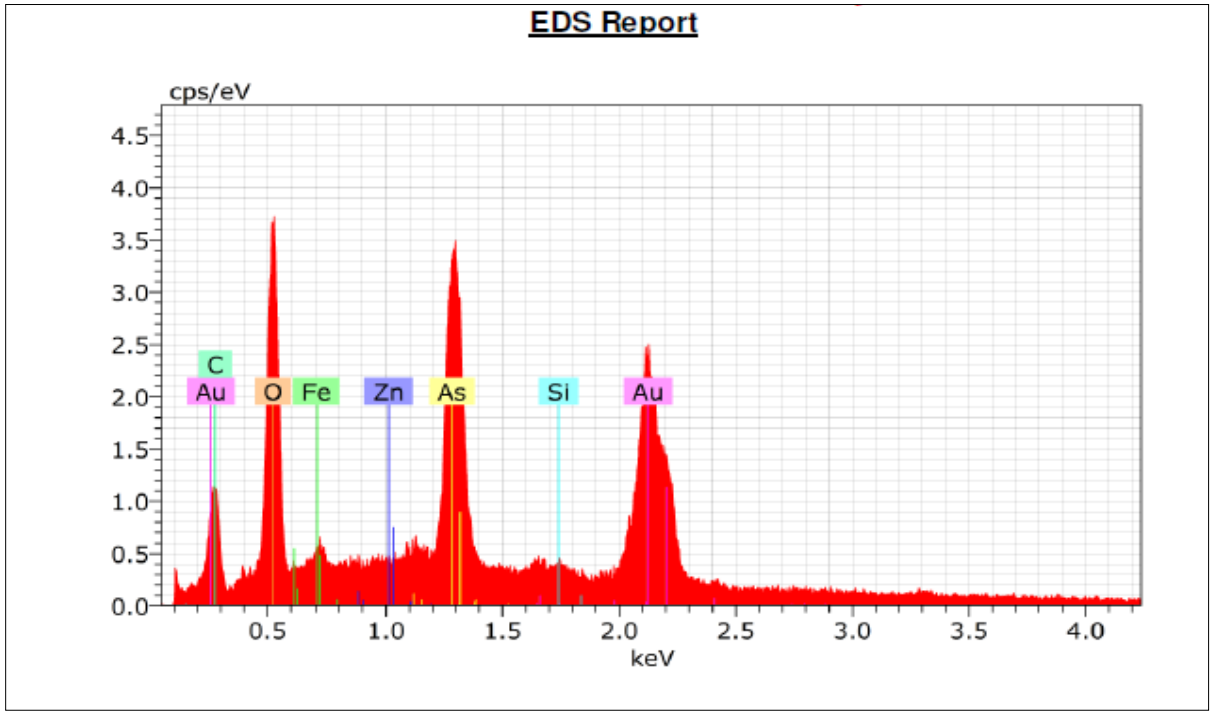


Fig 1d : FESEM image at 25000x Magnification

FESEM revealed the block shaped structure (Fig. 1)of the *Swarna bhasma* particles. These blocks were a conglomerate of various components found in composition of *bhasma*. These structures observed, confirmed that the *bhasmas* are an ayurvedic preparations[8]. It also showed nano-scale structure of *bhasma* particles. When reduced to this size any medicinal compound gains additional properties such as better bio-availability, lower dose requirement, target specificity, etc[2].



The EDS reports of *Swarna bhasma* (Fig. 2) showed peaks for Fe, Zn, Si these elements are common to found in any ayurvedic preparations. But, the As peaks found in the

sample were abnormal. According to literature, normal amount of arsenic found in *Swarna bhasma* is <1%[8] but in our sample it was found to be >26% (Table 1).

Table 1 Energy Dispersive X-ray Spectrometer Report of *Swarna bhasma* sample giving detailed composition of sample

ELEMENT	At. No.	Series	Unn. C (wt. %)	Norm. C (wt. %)	Atom C. (wt. %)	Error(1 Sigma) (wt. %)
Au	79	M- series	59.08	60.98	23.67	2.87
As	**33**	**L- series**	**26.03**	**26.87**	**27.42**	**1.37**
O	8	K- series	8.55	8.83	42.18	1.21
Si	14	K- series	1.59	1.64	4.47	0.14
Fe	26	L- series	1.37	1.41	1.94	0.33
Zn	30	L- series	0.26	0.26	0.31	0.06
		TOTAL	96.88	100.00	100.00	

It is widely known that arsenic is toxic to human cells at such high concentration. Thus, it was shocking to find these levels of arsenic in a branded medicinal product. Although, there are certain research papers that have noted anti-cancer benefits of arsenic when used in precise concentration especially against colon cancer[9]. There is a slight possibility that the manufacturer has considered those facts, however it is very unlikely.

The XRD pattern of *Swarna bhasma* sample (Fig. 3) reflects gold metal as the major phase along with certain impurities.

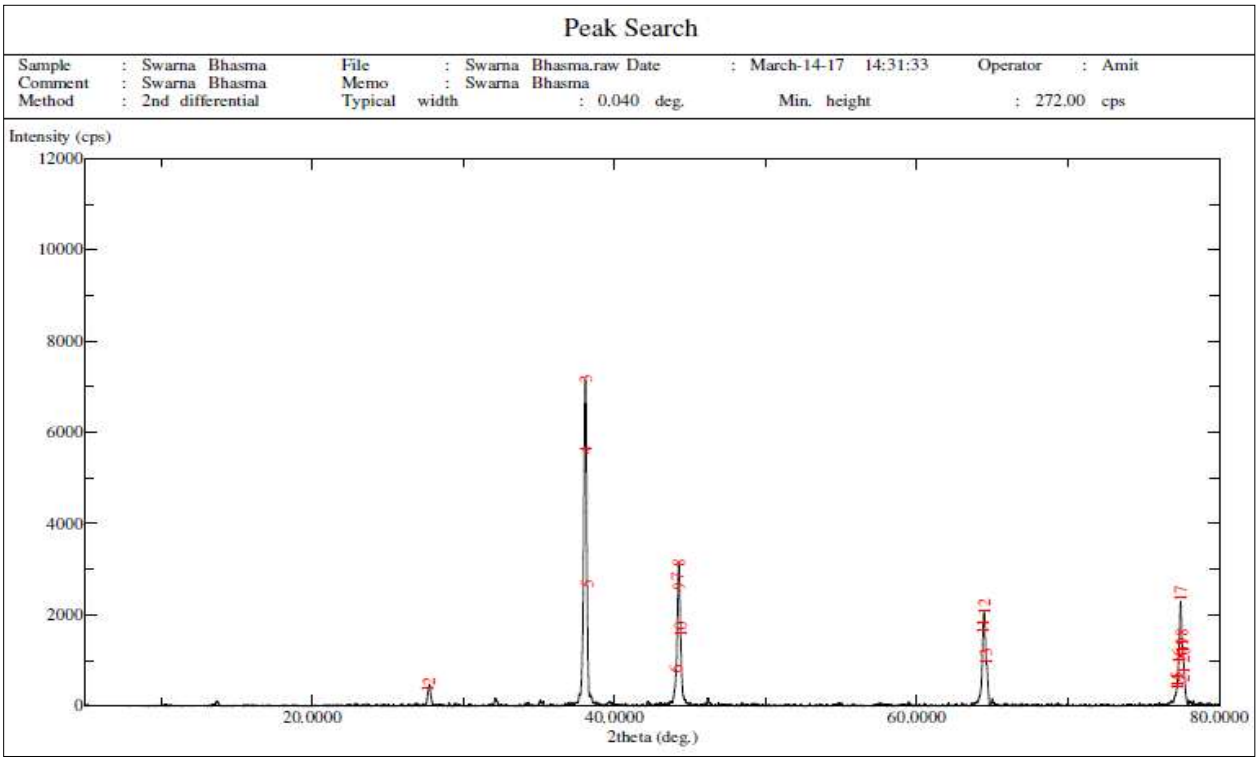


Fig 3: X-Ray diffraction pattern of *Swarna bhasma* sample

CONCLUSION

One of the branded *Swarna bhasma* samples used in the present studies showed fairly high antioxidant activity but antimicrobial activity at higher concentrations only and this Swarna *bhasma* is nano particulate in nature and contains significant quantity of metallic gold, higher levels of Arsenic and O, and traces of Fe, Si and Zn.

AKNOWLEDGEMENT

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REFERENCES

1. Prasanta Kumar Sarkar, Sanjita Das, P. K. Prajapati (2010). Ancient concept of metal pharmacology based on ayurvedic literature. Ancient science of life, 29(4), 1-6.
2. Santosh S. Kulkarni (2013). Bhasma and nano-medicine. International research journal of pharmacy, 4(4).
3. Singh Neetu, Chaudhary Anand (2011). *Swarna bhasma* and gold compounds: an innovation of pharmaceutics for illumination of therapeutics. International journal of research in Ayurveda and pharmacy, 3(1).
4. Iyshwarya H.S., Ashok D. Satpute. An antibacterial study of *Swarnamakshika Bhasma*. International ayurvedic medical journal,ISSN: 2320 5091.
5. APHA and AWWA (1985). The examination of water and waste water, 17th edition, Mcgraw Hill, USA.
6. Iyyappan Rajan, Remitha Rabindran, P R Jayasree, P R M Kumar (2014). Antioxidant potential and oxidative DNA damage preventive activity of unexplored endemic species of *curcuma*. Indian journal of experimental biology, 52, 133-138.
7. ElżbietaSikora, Jan OgonoWski (2011). Study of antioxidant properties of green tea extract. CHEMIK,65(10) 968-973.
8. Sanjay Khedekar, Anupriya, Galib R., Patgiri B.and Prajapati P. K. (2015). Chemical characterization of incinerated gold (*Swarna Bhasma*). Advances in Applied Science Research, 6(12), 89-95.
9. Jacqueline J. Stevens, Barbara Graham, Alice M., Paul B. Tchounwou and Christian Rogers (2010).The Effects of Arsenic Trioxide on DNA Synthesis andGenotoxicity in Human Colon Cancer Cells. International journal of environmental research and public health, 7.
10. A. M. Deshmukh (2003). Hand book of media stain and reagents in microbiology