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Method Development And Validation For Metal Analysis Of Herbal Drug (Abhrakbhasma) Using Inductive Coupled Plasma Optical Emission Spectroscopy

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ABSTRACT:

Herbal medicines have been using for the treatment, management, and prevention of different types of diseases by majority of the population in India since time immemorial. These medicines are effective besides being easily available, and inexpensive compared with allopathic drugs. In recent times, several cases of heavy metals in herbal medicine have come to light. As a result, regulators have started monitoring for controlling the quality of herbal medicines. The present study pertains to the development of a validated method to determine the content of lead, cadmium, arsenic, and mercury in Abhrak Bhasma. Inductive coupled plasma optical emission spectroscopy was used for this purpose. The present study was performed to evaluate heavy metals contents by Inductive coupled plasma optical emission spectroscopy. Correlation coefficient was calculated from the linear regression analysis proved that the developed method obeys linearity for Abhrak Bhasma. Results for %RSD for replicates of each standard of Abhrak Bhasma was found to be in the range of 0.16 to 1.89. Results for %RSD for 3 replicates of sample solution of Abhrak Bhasma was found to be 0.16 to 2.94. The obtained %recovery for check standard of Abhrak Bhasma was found to be in the range of 91-104.50%. The results indicate that ICP-OES is an alternative method for use in the determination of heavy metals and other elements of interest in herbal medicines and for quality control of crude drugs and their products.

Keywords: Abhrak Bhasma, Inductive coupled plasma optical emission spectroscopy, Method development, Validation

INTRODUCTION:

A Highly advanced study to detect metals can be done by Inductively Coupled Plasma (ICP) based analytical techniques can provide quantitative bulk elemental composition of a wide variety of sample types, including powders, solids, liquids, and suspensions. Solid samples are generally dissolved or digested using a combination of acids in a closed microwave system, thus retaining potentially volatile analyte species. The resulting model resolution is then nebulized into the core of inductively coupled argon plasma, where tempertures of almost 9000 K are attained. At such high temperatures, the nebulized solution is vaporized, and the analyte species are atomized, ionized and thermally excited. The analyte species can then be noticed and quantitated with a

optical emission spectroscopy (OES). optical Emission Spectroscopy, or OES, is a well right hand and widely cast off analytical system used to regulate the vital alignment of a broad choice of metals. The part of the electromagnetic spectrum which is used by OES embraces the noticeable spectrum and part of the ultraviolet spectrum. In rapports of wavelength, that's from 130 nanometers up to around 800 nanometers. OES can analyze a wide range of elements from Lithium to Uranium in solid metallic examples causing a wide attention choice, giving high accuracy, precision and low detection limits.

This analytical method has become method of choice for the determination of metal analysis in various natural products and one of the sample Abhrak Bhasma has been analysed. Abhrak Bhasma is a classical ayurvedic formulation that employs the use of abhrak ash or calcined mica ash for treating and managing a quarry of health anomalies including reproductive problems, respiratory disorders, liver & abdominal diseases, mental and psychosomatic disorders. This potent mineral formulation is blessed with the ability of pacifying the Tridoshas, i.e. Vata, Pitta and Kapha. Being a powerful Rasayani dravya or ingredient, Abhrak bhasma not only provides adequate energy to carry out various activities but also has a calming effect on both the mind and body.

METHODOLOGY

DETAILS OF METHOD:

Instrument Details

Name of the Instrument: ICP-OES Make: Perkin
Elmer
Model: Optima 8000
Instrument Parameters: Followed the instrument default parameters as per Perkin Elmer.

PREPARATION OF STANDARDS AND SAMPLES:

Standards and Sample Preparations for Abhrak Bhasma

Preparation of Diluent:
Transferred 1.0ml of concentrated nitric acid to a 100ml volumetric flask and diluted upto volume with the ultrapure water.

Preparation of mixed stock standard-1:
Transferred 0.1mL of Lead 1000mg/L, 0.2mL of Arsenic1000mg/Land

0.4mL of Mercury 1000mg/L to a 20mL volumetric flask and diluted upto volume with the ultrapure water.

Preparation of mixed stock standard-2:
Transferred 1.0 mL of above mixed stock standard-1 to a 10 mL volumetricflask and added 0.1 mL

of Potassium 1000 mg/L and 0.1 mL of Calcium 1000mg/L and diluted upto volume with the ultrapure water. Transferred 1.0mL, 2.0mL and 3.0mL of above mixed stock standard-2 to a separate 10mL volumetric flasks and diluted upto volume with the diluent.

Preparation of Sample:

Taken 3.00625 g of the sample to a 50 mL beaker and added 3.0 mL of concentrated Nitric acid and dissolve the sample, and diluted up to 10 mL with the diluent. Filter the sample through 0.45pm Nylon Filter.

Linearity results:

The correlation coefficient was found to be as mentioned below:

Linearity was established by plotting a calibration curve between emission intensity vs corresponding metal concentrations. Correlation coefficient was calculated from the linear regression analysis proved that the developed method obeys linearity for Abhrak bhasma.

Table1: Linearity results for Abhrak Bhasma

S.No	Name of the element	Obtained correlation Coefficient for Abhrak Bhasma
1	Lead(Pb)	0.999947
2	Arsenic(As)	0.999969
3	Mercury(Hg)	0.992565
4	Potassium(K)	0.999503
5	Calcium(Ca)	0.999923
6	Cadmium(Cd)	NA
7	Magnesium(Mg)	NA
8	Aluminium(Al)	NA

Table 2: Results for %RSD for 3 replicates of each standard of Abhrak Bhasma

S.no	Name of the element	Obtained %RSD for three replicates (%) of Abhrak Bhasma		
		Standard 1	Standard 2	Standard 3
1	Lead (Pb)	1.09	0.83	0.78
2	Arsenic (As)	1.06	0.63	0.64
3	Mercury (Hg)	1.89	0.23	0.16
4	Potassium (K)	1.44	1.38	1.86
5	Calcium (Ca)	0.17	0.65	0.50
6	Cadmium (Cd)	NA	NA	NA
7	Magnesium (Mg)	NA	NA	NA
8	Aluminium (Al)	NA	NA	NA

Table 3: Results for % RSD for 3 replicates of sample solution of Abhrak Bhasma

S.No	Name of the element	Obtained % RSD for three replicates(%) of Abhrak Bhasma
1	Lead(Pb)	1.29
2	Arsenic(As)	0.54
3	Mercury(Hg)	0.16
4	Potassium(K)	2.94
5	Calcium(Ca)	2.04

6	Cadmium(Cd)	NA
7	Magnesium (Mg)	NA
8	Aluminium(Al)	NA

The results for Abhrak Bhasma was found to be as mentioned below.

Table 4: Results of Abhrak Bhasma

S.No	Name of the element	Obtained results (mg/L) of Abhrak Bhasma
1	Lead(Pb)	0.25
2	Arsenic(As)	0.51
3	Mercury(Hg)	1.01
4	Potassium(K)	4.88
5	Calcium(Ca)	4.50
6	Cadmium(Cd)	NA
7	Magnesium (Mg)	NA
8	Aluminium(Al)	NA

Table 5: Recovery (%) of Abhrak Bhasma

S.No	Name of the element	Obtained % recovery (%) of Abhrak Bhasma
1	Lead(Pb)	99.00
2	Arsenic(As)	104.50

3	Mercury(Hg)	91.00
4	Potassium(K)	99.55
5	Calcium(Ca)	92.00
6	Cadmium(Cd)	NA
7	Magnesium(Mg)	NA
8	Aluminium(Al)	NA

SUMMARY AND CONCLUSION

Correlation coefficient was calculated from the linear regression analysis proved that the developed method obeys linearity for Abhrak Bhasma. The %RSD was evaluated each for 3 repetitive times for each standard and each sample solution. The %RSD values for the generated data were below the accepted criteria. Hence the developed method was precise. % Recoveries were calculated and were below the acceptance criteria. The proposed method was based upon determination of check standard recoveries. The obtained percentage recoveries are shown in tables and were within the ICH acceptance criteria. Hence the developed method was accurate.

Conclusion:

The presence of heavy metal impurities in pharmaceutical preparations meant for administration may lead to toxicity. In order to determine such impurities, there is an inevitable need for developing and validating analytical methods with sensitivity. Therefore, the developed method for quantification of heavy metals was found to be selective, accurate and precise in accordance with regulatory guidelines and can be successfully employed for routine commercial analysis of Abhrak Bhasma.

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