



Determination of Arsenic content in the Water and Blood samples of Ballia region using Hydride Generation Atomic Absorption Spectrophotometer

Chaurasia Neha¹, Pandey S.K.¹ and Mohan Devendra³

¹Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, INDIA

³Head of Department, Department of Civil Engineering, IIT, Banaras Hindu University, Varanasi, INDIA

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Abstract

In this research article the arsenic contents was determined using HGAAS. The water and blood samples were collected from Ballia region, the samples were prepared for testing with the help of HGAAS. Arsenic in drinking water is the major cause of Arsenic toxicity. Most of the reports highlighted chronic Arsenic toxicity in man increases. In contrast inorganic arsenic compound are known human carcinogens, based on sufficient evidence of carcinogenicity in human. From view point of health gastrointestinal effects, anemia, peripheral neuropathy, skin lesions, hyper pigmentation, and liver or kidney damage in humans. Inorganic arsenic exposure in Human. By the inhalation has been shown to be strongly associated with lung cancer, while ingestion of inorganic arsenic in humans has been linked to a form of skin cancer and also to bladder, liver, and lung cancer. Hydride generation atomic absorption spectrometry (HGAAS) is highly specific technique, which is widely used for trace metal analysis, This HGAAS is stable, easy to operate and produces sufficient atomization to enable good sensitivity and freedom from much inter element interference is a very valid option for elemental analysis, with the help of this technique, it can be analyzed.

Keywords: Hydride generation atomic absorption spectrometry.

Introduction

Environmental pollution is one of the most serious problems we are facing today. Metal pollution is one of the major causes of environment pollution. Arsenic exposure to human is mostly through drinking water. Toxicity of Arsenic totally depends on the form in which arsenic is present. Inorganic arsenic, typical in drinking water, is much more toxic than organic ones. Arsenic may attack internal organs without causing any visible print, so it's very difficult to recognize. The indispensability, deficiency or toxicity of arsenic is manifestation of dose response effects; blood is also a good indicator for presence of arsenic in human body.

Hydride generation atomic absorption spectrometry (HGAAS) most widely used techniques for trace metal analysis¹. This HGAAS is simple to operate with the help of this technique easily examine metal toxicity in water, soil and other biological samples.

Material and Methods

Pre-sampling method: Clean-up of sample container: Sample containers should be scrupulously clean so as not to introduce contaminants that could interfere with quantification of the target analyte(s). This is very important task for determination of trace or ultra-trace elements and their concentration levels. The following cleaning procedure has been set up for cleaning the sample bottles. Different type of bottles

whether borosilicate glass, linear polyethylene, polypropylene, or PTFE clean by this method.

Detergent → Tap water → 1:1 HNO₃ → Tap water → 1:1 HCl → Tap water → Reagent water

Collection and Preservation of Water Samples: Water samples of about 500 ml were collected from different water sources in polyethylene vials these vials are pre-treated with clean up procedure. Before filling, rinse the bottles two or three times with the water being collected. After collection, sample is acidified with concentrate nitric acid to a pH below 2 to minimize precipitation and adsorption of heavy metals on the container walls². After acidifying sample transfer to the lab and kept in refrigerator at 4°C temperature until further analysis³.

Collection and Preservation of Blood Samples: Blood samples of about 5ml have been taken from the medial cubital vein in the arm using disposable syringes. Soon after samples were transferred to pre cleaned, metal- free heparinized polypropylene vials about 10 ml. collection tubes were then numbered and put in to cryo-box having ice pieces, finally packed and transported with in 24 hr of sample collection. All these samples were kept in refrigerator at 4°C until further analysis¹.

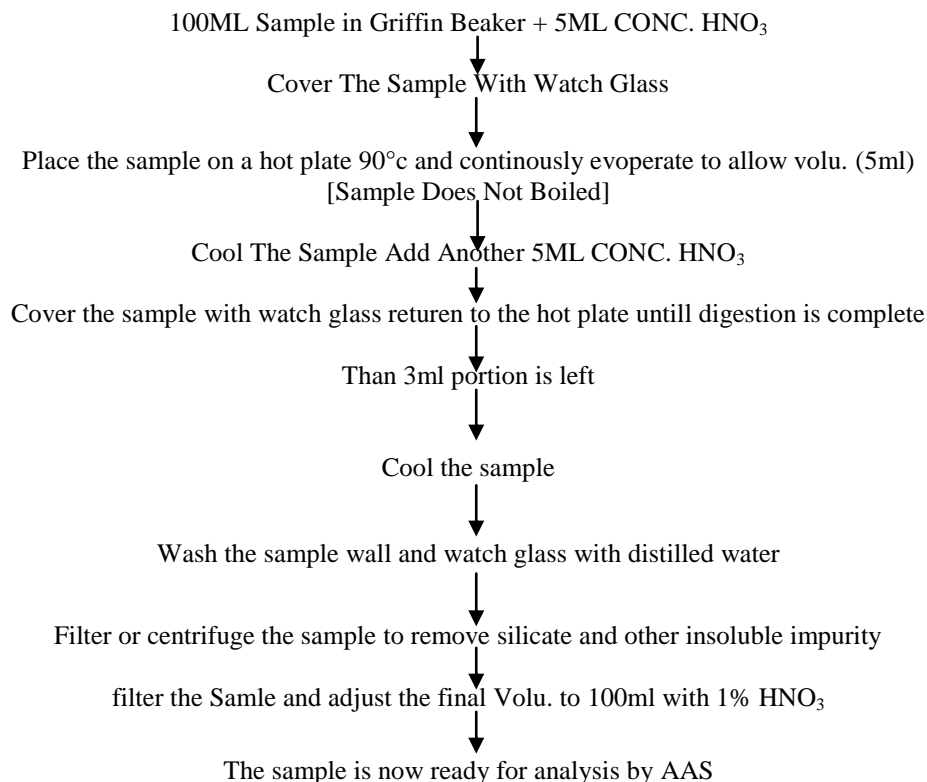
Digestion of water and blood samples: Apparatus and Materials: i. Digestion Vessels: 250 ml conical glass flask, ii. Volumetric Flasks of 100-ml, iii. Graduated measuring glass

cylinder up to 100-ml, iv. Glass Funnel, v. Watch Glass, vi. Centrifuge tubes, vii. Analytical electronic balance, viii. Drying ovens with thermostat: able to maintain $30^{\circ}\text{C} \pm 4^{\circ}\text{C}$, ix. Heating source (Hot Plate) with electro thermostat device, x. Adjustable and able to maintain a temperature of $90-95^{\circ}\text{C}$, xi. Filter paper: Whatman No. 41.

Reagents: Various reagents used for digestion process: i. AR grade chemicals (Merck) were used in all tests. ii. All reagents conforms the specifications of the committee on Analytical Reagents of the American Chemical Society. iii. Triple distilled water, iv. Nitric acid (concentrated), HNO_3 (70%), v. Perchloric Acid, HClO_4 (70 % GR), vi. Freshly prepared Digestion mixture (concentrate Nitric Acid 6 part+ Perchloric Acid one part).

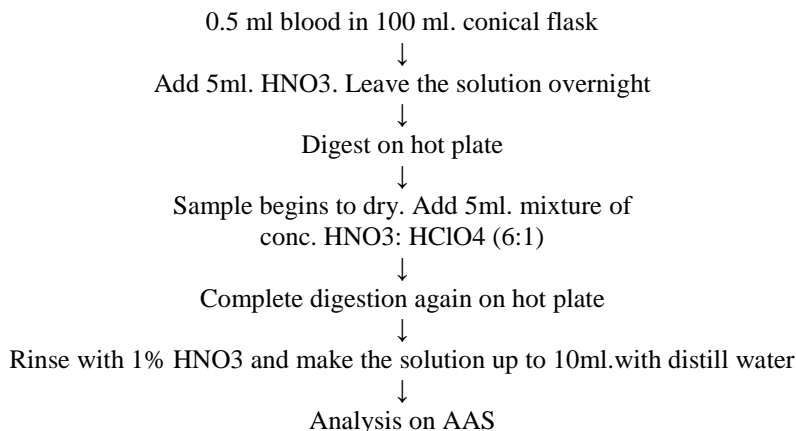
Digestion procedure

Digestion of water sample on Hot Plate-A Detailed Procedure for quantitative estimation of Arsenic



Digestion of Blood sample on Hot Plate:-

Digestion of blood sample on Hot Plate-A Detailed Procedure for quantitative estimation of Arsenic



Post-sampling method: Analysis and estimation of Arsenic by HG-ASS (Elico, Haring et al. 1982): Estimation of concentrations of studied Arsenic from extracted solutions of water was done by the Hydride Generation Atomic Absorption Spectrophotometer (HGAAS)⁵ is used to get better, results as recommended by the instruction manual of manufacturer (Elico Ltd.)⁶.

Set up of different Parameters: i. Flame : Nitrogen-acetylene, ii. Wavelength : 193.7 nm, iii. EHT : 570, iv. Lamp Current : 10 mA, v. Slit width : 0.4, vi. Lamp Energy : 1.6 volt, vii. Sensitivity : 0.06.

Reagents: i. Nitrogen gas, ii. Acetylene gas, iii. Triple distilled water, iv. Calibration stock solution, 1000 µg/l As commercial standard, v. 1% HCl (carrier solution), vi. 10% HCl (blank solution), vii. Potassium borohydride solution (1.5%).

Calibration and Quality control: i. Standard stock solution of 1000 mg/l of As is diluted with 10% concentrate HCl to prepare the required working standards of different concentrations as per the working range of instrument. ii. Prepare a series of working standards 2 ng/ml, 4ng/ml, 6ng/ml and 8ng/ml. iii. Store the working standards solution in polypropylene bottle and prepare freshly. iv. Analyze the working standards with the blanks and samples. v. Prepare a calibration graph of absorbance vs. solution concentration (µg/l). vi. Aspirate a standard for every 10 samples to check for instrument drift.

Determination of concentration of metal: i. Set up AA spectrometer with simultaneous background correction and air acetylene burner according to manufacturer's instructions. ii. Set up burner and gas controls according to manufacturer's specifications. iii. Analyze standards, samples and again standards. iv. Aspirate water between each sample to avoid cross contamination. v. Plot a calibration curve and calculate blank and sample solution concentrations from the curve allowing for the standard blank. vi. The value of R should be more than 0.99.

Conclusion

With the help of this technique we examined alkalis, alkaline earths, and transition metals. AAS is a very sensitive form of spectrophotometry, as it can detect elements with a concentration of less than one part per million in a small sample of the solution. Atomic absorption spectroscopy (AAS) is the appropriate and simple to operate but the drawback of this technique is that the single metal detect in one time no two lamp used in single time. This is universally accepted technique, most of the researcher working on this technique. Sample preparation is often simple. This is because atomisation converts the sample into free atoms. The sample is weighed and made into a solution by suitable dilution. Elements in biological fluids such as urine and blood are often measured simply after a dilution.

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