ATOMIC ABSORPTION SPECTROSCOPY

CONTENTS: Introduction,principle,interferences, instrumentation,applications

INTRODUCTION: Atomic absorption spectroscopy is a method of elemental analysis. It is particularly useful for determining trace metals in liquids and is almost independent of the molecular form of the metal in the sample.

PRINCIPLE: The Atomic absorption spectroscopy may be accomplished by using a flame whereby the sample solution is aspirator directly into a flame or by using an electro thermal device thereby the sample solution is first evaporated and then ignited on a hot surface. It has been noticed that the gaseous metal ions in an excited form that is ground state atoms will absorb Radiant energy related to their own specific resonance wavelength .Hence when a light with the same resonance wavelength is passed through a flame comprising of such atoms, a part of the light will be absorbed accordingly .Besides the degree of absorption would be directly proportional to the total number of ground state atoms present in the flame with ultimately forms the basis of Atomic absorption spectroscopy.

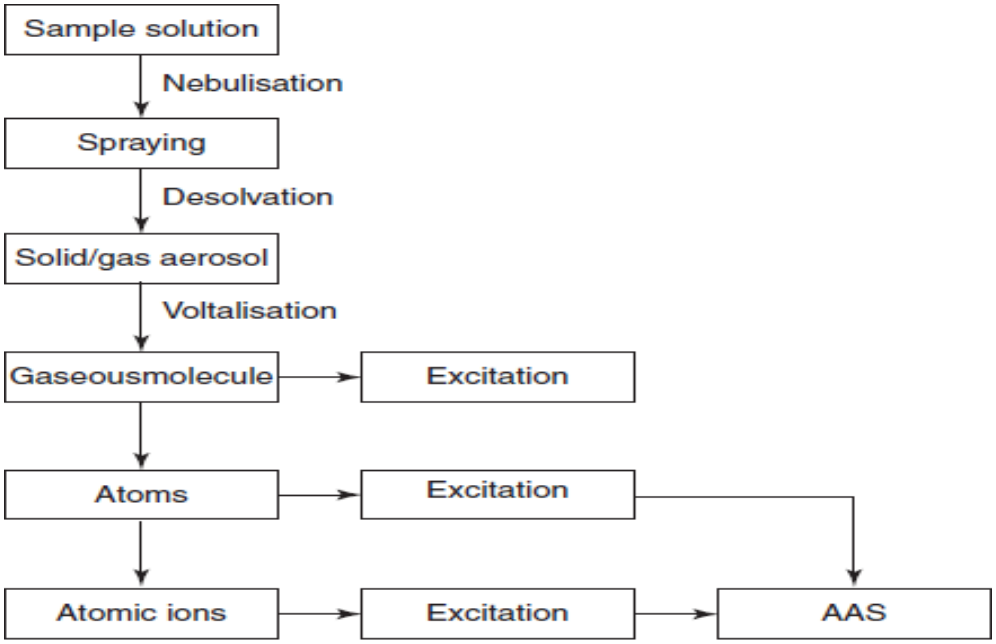


Fig.1) Steps in Atomic Absorption Spectroscopy

INSTRUMENTATION

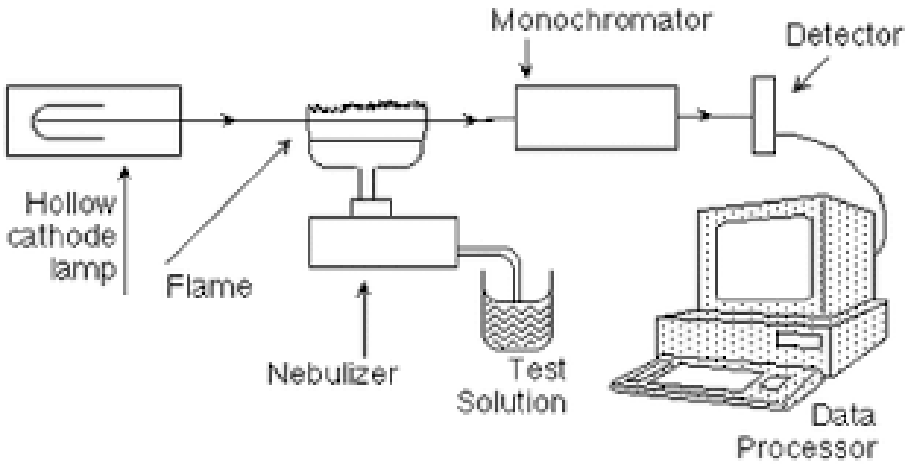


Fig.2) Block Diagram of Atomic Absorption Spectroscopy

1.Light source

Hollow cathode lamp are the most common radiation source in atomic absorption spectroscopy.

It contains a tungsten anode and hollow cylindrical cathode made of the element to be determined .

These are sealed in a glass filled with an inert gas.

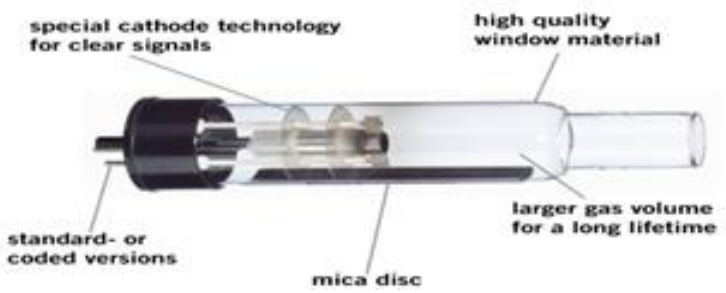


Fig.3) Hollow Cathode Lamp

2.Nebulizer

Suck up liquid sample at Controlled rate.

Create a fine aerosol spray for introduction into flame.

Mix the aerosol and fuel and oxidant thoroughly for introduction into flame.

3.Atomizer

MIX the aerosol and fuel and oxidant thoroughly for introduction into flame.

Element to be analyze need to be in atomic state .

Atomization is a separation of particle into individual molecule and breaking molecule into atom .

This is done by exposing the analyte to high temperature in a flame or a graphite

A. Flame atomizer

To create flame ,we need to mix and Oxidant gas and a fuel gas.

In most of the cases, air acetylene flame or nitrous oxide acetylene flame is used. Liquid or dissolved sample are typically used with flame atomizer.

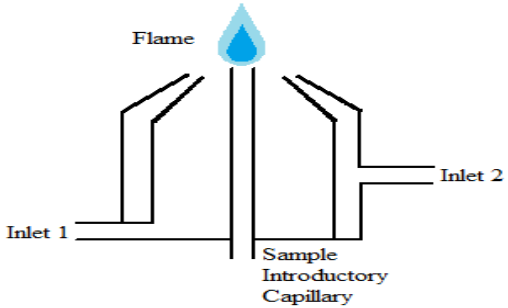


Fig.4) Flame Atomizer

B. Graphite tube atomizer

uses of graphite coated furnace to vaporize the sample.

In GFAAS sample ,samples are deposited in a small graphite coated tube which can then be heated to vaporize and atomize the

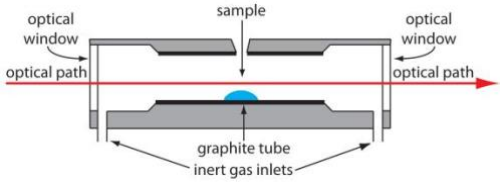


Fig.5) Graphite Tube Atomizer

4.Monochromator

This is a very important part in an AA spectrometer.

It is used to separate out all of the thousands of line.

Monochromator is used to select the specific wavelength of light which is absorbed by the sample and to exclude other wavelength.

The selection of specific light allows the determination of the selected element in the presence of others

5.Detector

A light selected by the monochromator is directed into a detector that is a typically a PMT. Whose function is to convert the light signal into electrical signal proportional to the light intensity

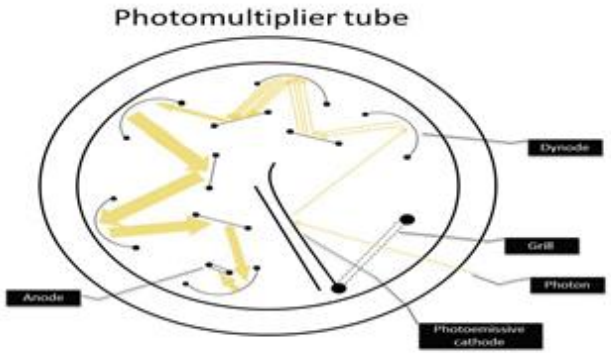


Fig.6) Photomultiplier Tube

6.Calibration curve

A calibration curve is used to determine the unknown concentration of an element in a solution.

The instrument is a calibrate using a several solution of known concentration.

The absorption of each known solution is measured and then a calibration curve of concentration versus absorption is a plotted.

INTERFERENCES: It has been stated earlier that Atomic absorption is almost free from spectral interference, because a particular element can absorb light only of its own characteristic frequency and conversely the light of particular frequency will be absorbed by atoms of a specific element

1)Ionization interference

Ionisation Interference arise Atomic absorption if the flame temperature is too high.
When this occurs a number of the vapourised atom become ionized by flame.

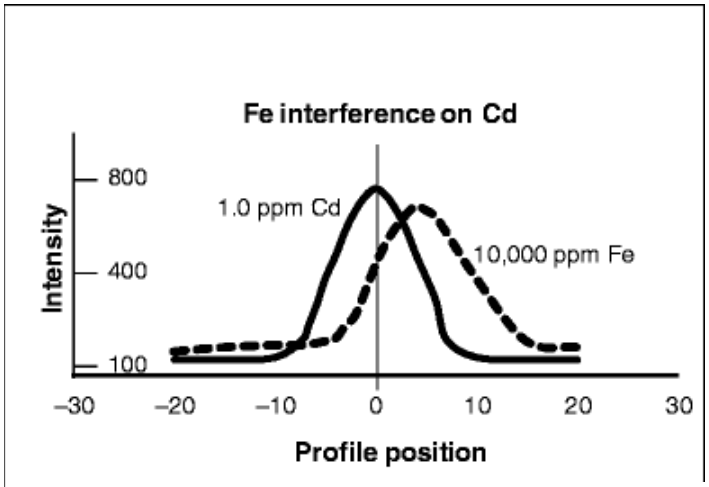


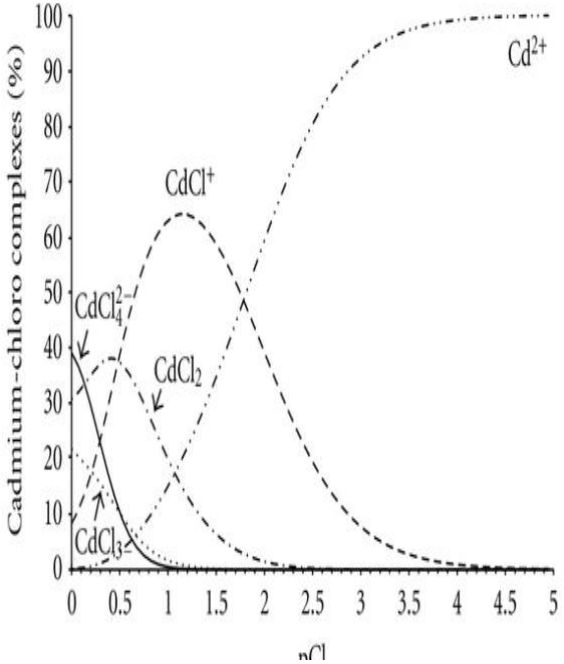
Fig.7) Interference in AAS

2)Chemical interference

It might be removed by the use of a higher flame temperature.

In situation where a hotter flame cannot be utilised chemical means are suggested.

Example: Aluminium and Magnesium form a thermally stable mixed oxide.



3)Spectral Interference

This type of interference may be caused by overlapping of any radiation with that of characteristic radiation of the test lement to be estimated.

The interfering radiation may be an emission line of another line of another element, radical or molecule on resolved by band spectra or general background radiation from the flame , solvent,etc.

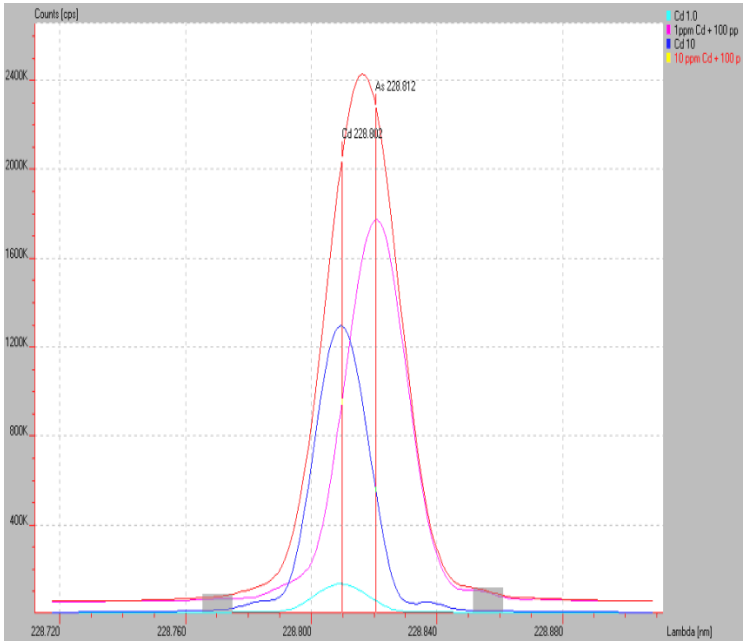


Fig.8) Spectral Interference

Applications of Atomic Absorption Spectroscopy

Biological analysis

Biological samples can include both human tissue samples and food samples. In human tissue samples, AAS can be used to determine the amount of various levels of metals and other electrolytes, within tissue samples

Environmental and marine analysis

Environmental and marine analysis typically refers to water analysis of various types. Water analysis includes many things ranging from drinking water to waste water to sea water.

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