Atomic Absorption Spectroscopy

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- ✓Principle
- ✓Instrumentation
- ✓Applications
- ✓Interference

Spectroscopy
Instrumental Analysis

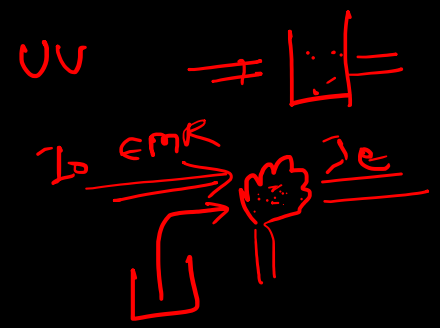
Atomic Absorption Spectroscopy

Introduction:

- Atomic absorption spectroscopy (AAS) is instrumental method for the determination of metallic elements, which is based on absorption of EMR.
- It was developed by Alan Walsh in 1950 and used from 1955.
- It is the best analytical techniques to quantitatively estimate the metallic elements at trace level (ppm-ppb)
- AAS is a method of analysis based on absorption of radiation by atoms when a solution of metallic salt is aspirated (drawing) into a flame.

Atomic Absorption Spectroscopy

Principle:

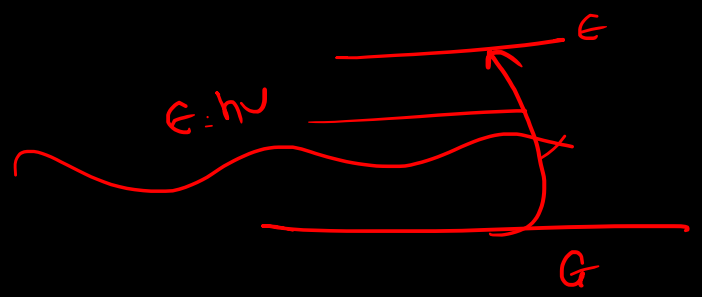


- AAS method is similar to that of spectrophotometer.
- The only exception is the replacement of the sample cell by a flame.
- In AAS, a monochromatic light for a particular element is produced by a hollow cathode lamp utilizing that element as the cathode.
- The heat energy dissociates the molecules and converts the components to atoms.
- At flame temperature, some atoms in the solution are activated, but most of the atoms are remain in the ground state.
- the ground state atoms of the same element as in the hollow cathode cup absorb their own resonance (reflected) lines.
- The amount of light absorbed varies directly with their concentration in the flame.

Atomic Absorption Spectroscopy

Principle:

- The transmitted light that is not absorbed reaches the monochromator.
- The monochromator passes only the wavelengths close to the resonance lines of the particular element to be analysed.
- Then the transmitted light strikes a detector and the decrease in transmitted light is measured.



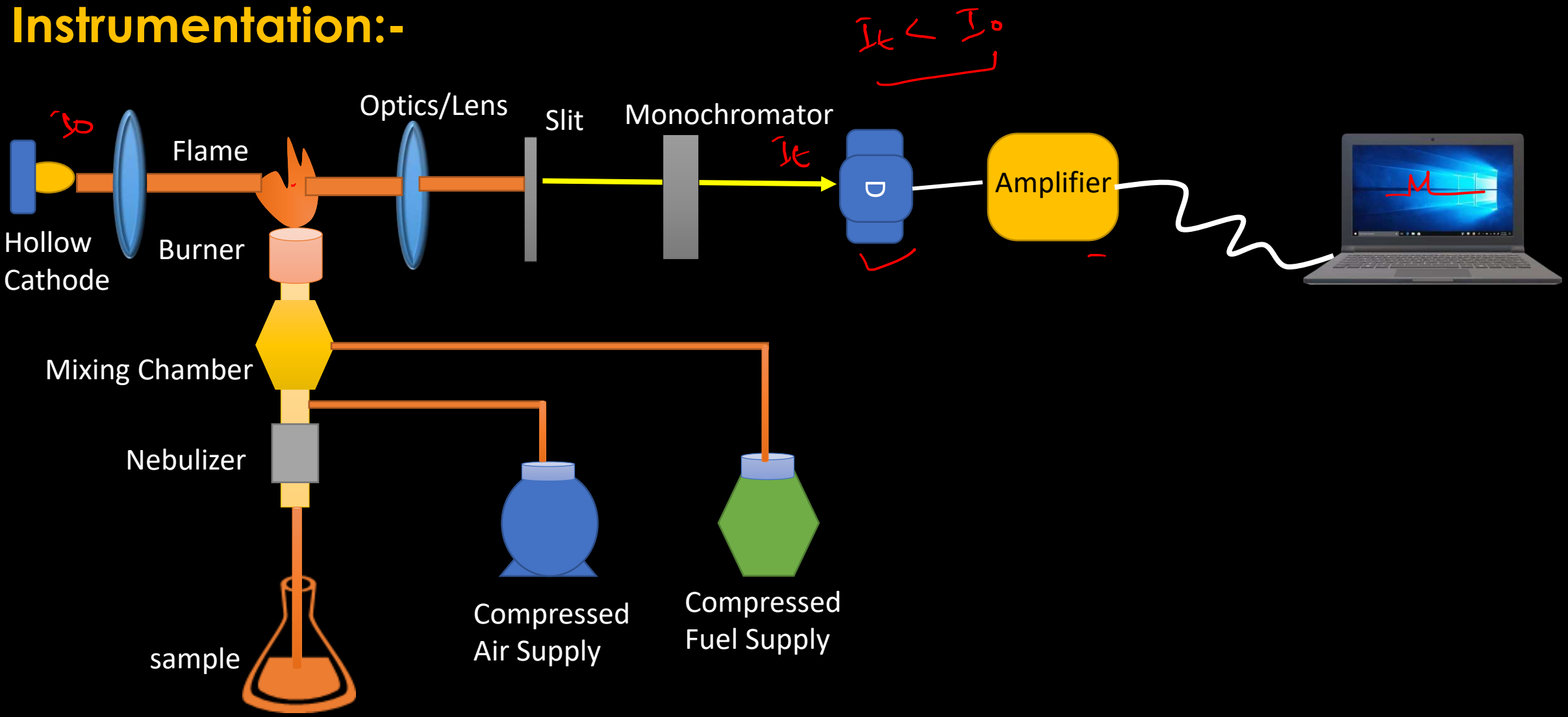
Atomic Absorption Spectroscopy

Instrumentation:

- The components of an AAS are
  1. Hollow cathode lamp
  2. Beam chopper
  3. The flame or furnace
  4. Nebulizer
  5. Monochromator
  6. Detector
  7. Amplifier.

Atomic Absorption Spectroscopy

Instrumentation:-



Atomic Absorption Spectroscopy

Instrumentation:

- The components of an AAS are

1. Hollow cathode lamp:

- The most widely used light source is the hollow cathode lamp.
- These lamps are designed to emit the atomic spectrum of a particular element, and specific lamps are selected for use depending on the element to be determined.

Metal	Zn	Fe	Cu	Ca	Na
λ (nm)	214	248	325	423	589

1. Beam chopper
2. The flame or furnace
3. Nebulizer
4. Monochromator

Atomic Absorption Spectroscopy

Instrumentation:

2. Beam chopper

- It is used to reduce the noise of source of radiation .
- One half is transferred towards the atomization source and half the sample.

3. Nebulizer

- To spread the solution over the flame

4. Monochromator

- Grating type

5. Detector

- Photomultiplier tube

Atomic Absorption Spectroscopy

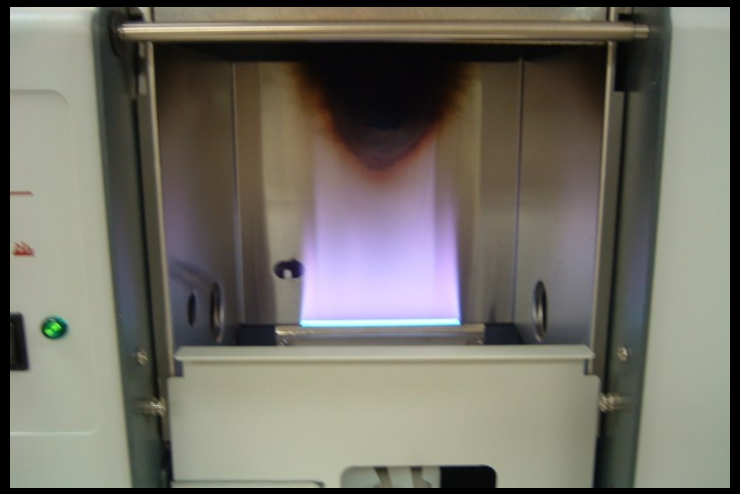
Application:

- Water analysis (Ca, Mg, Fe, Si, Al, Ba content).
- Food analysis.
- Analysis of animal feedstuffs (Mn, Fe, Cu, Cr, Se, Zn).
- Analysis of additives in lubricating oils and greases (Ba, Ca, Na, Li, Zn and Mg).
- Analysis of soil.
- Clinical analysis (blood samples, plasma serum – Ca, Mg, Li, Na, K and Fe).

Atomic Absorption Spectroscopy

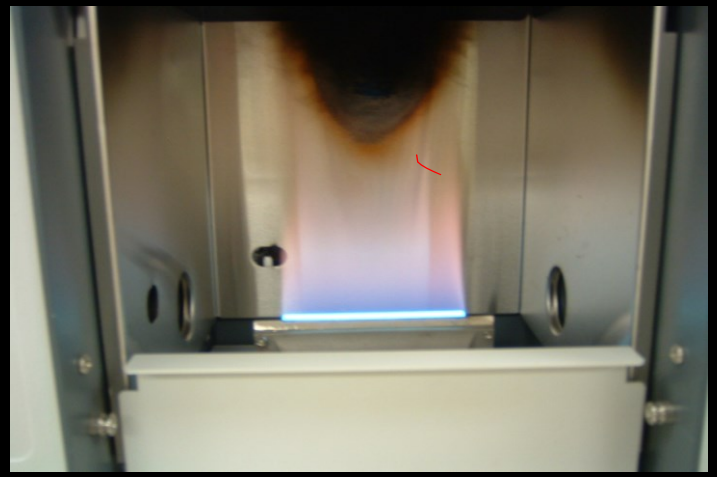
Calcium

Copper



Potassium

Mangnease



Cobalt

Interferences

- Spectral interferences due to radiation overlapping that of the light sources
- Formation of compound that do not dissociate in the flame e.g., Calcium phosphate
- Ionization of the analyte reduces the signal
- Disturbance in viscosity and surface tension

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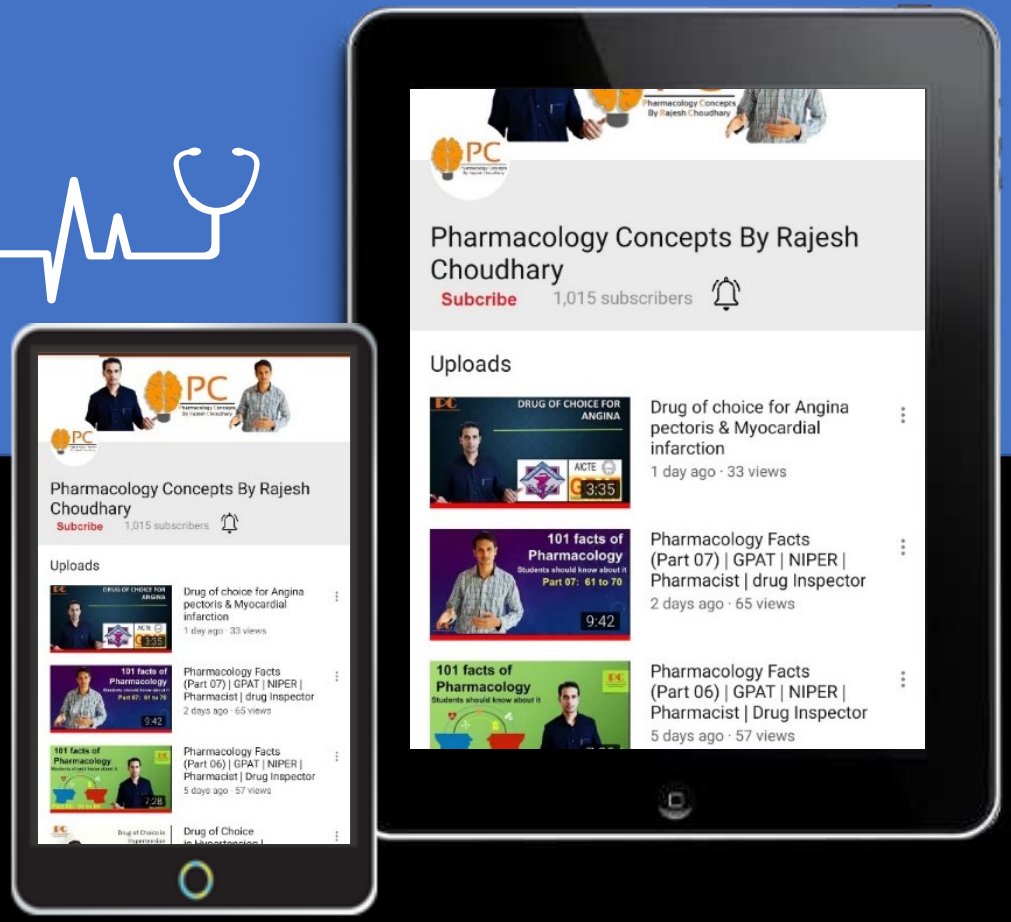

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