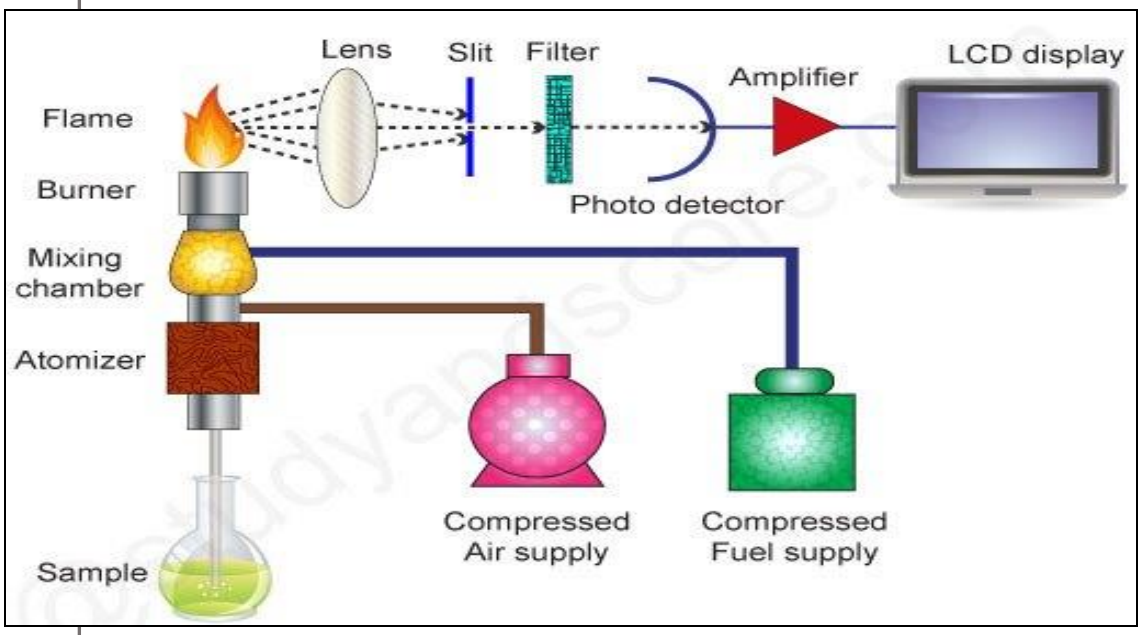
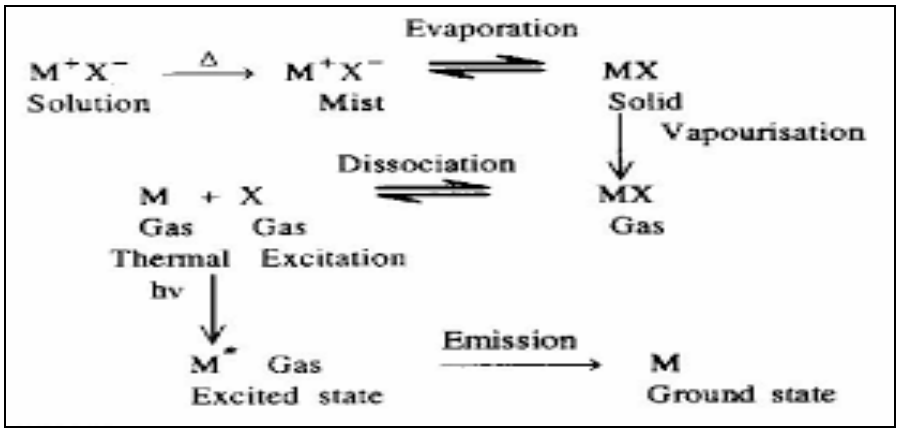
Flame Photometry

Flame photometry is a technique in which the intensity of the emitted light is measured when atomized metal is introduced into the flame. The wavelength and intensity of the colour indicates the element and the % of that element in the compound.



1.14.1. Principle



When metallic salt solution is introduced into the flame the following changes occurs.

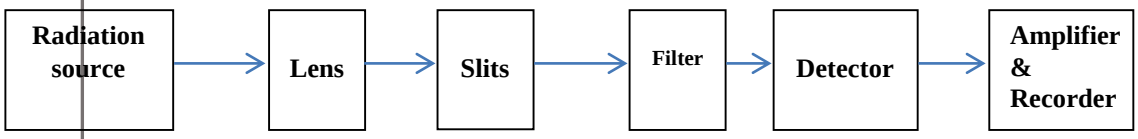
(a) Evaporation of solvent.

(b) Vaporization of salt.

(c) Dissociation of salt.

(d) Thermal excitation and return to the ground state with emission of radiation. **1.14.2.**

1.14.2.Instrumentation:



Block diagram of flame photometer

Components:

Radiation source: Acetylene – air flame or propane – air flame is used as radiation source, and which provides the temperature greater than 2000 K, in order to convert the metal into an atomic vapour state.

Lens:

It is used to increase the amount of radiation reaching the detector.

Slits:

There are two types of slits.

(a) Entrance slit: It permits only the radiation comes from the lens.

(b) Exit slit: It prevents the entry of interfering lines.

Filter:

It is also called monochromator. It allows the light of required wavelength only.

Detector:

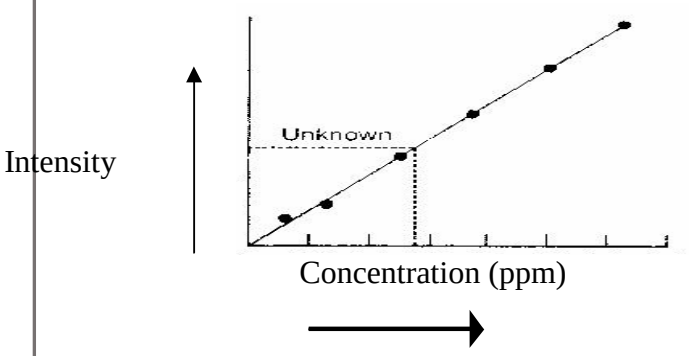
It measures the intensity of radiation falling on it and it is converted into current.

Amplifier & Recorder:

The current coming out from the detector is weak, so it is amplified and recorded.

Working:

The sample is mixed with air and fuel gas in the mixing chamber and this mixture is passed into the burner. The radiation emitted from the flame is passed successively into the lens, filter, detector and finally into the recorder. The above experiment is carried out using a series of standard solutions and the readings noted for each trial. Finally a graph of calibration curve is drawn between concentration verses intensity of emitted light. After finding out the intensity of test solution experimentally, the concentration will be determined from the graph.



1.14.3. Advantages:

- It is a well – understood technique.
- Low running and maintenance cost.
- Measurement is possible in a wide range of liquid systems.

1.14.4. Drawbacks:

- It is necessary to use liquid samples.
- It never emits the light on the molecular form of the metal present in the test solution.
- All metal ions and inert gases cannot be determined.

1.14.5. Applications:

- It is very useful to detect the alkali and alkaline earth metals from the colour of the flame. Li – Scarlet red colour(= 670 nm), Na – yellow colour (= 589 nm) and Ca – Brick red colour (= 422 nm).
- It is used in biological fluids and tissue analysis for the determination of Na, K, Ca& Fe
- In soil analysis Na, K, Al, Ca& Fe, etc are determined.
- It is used to estimate alkali & alkaline earth metals in their metal salt solutions.

1.14.6. Limitations:

- Liquid samples must be used.
- Other than alkali & alkaline earth metals cannot be detected.