FLAME PHOTOMETRY (OR) FLAME EMISSION SPECTROSCOPY

Principle

Working

Application

Flame photometry

Flame photometry is a method in which, the intensity of the emitted light is measured, when a atomized metal is introduced into a flame. The **wavelength** of the colour tells us **what the element is,** and the **intensity** of the colour tells us **how much of the element is present.**

Principle

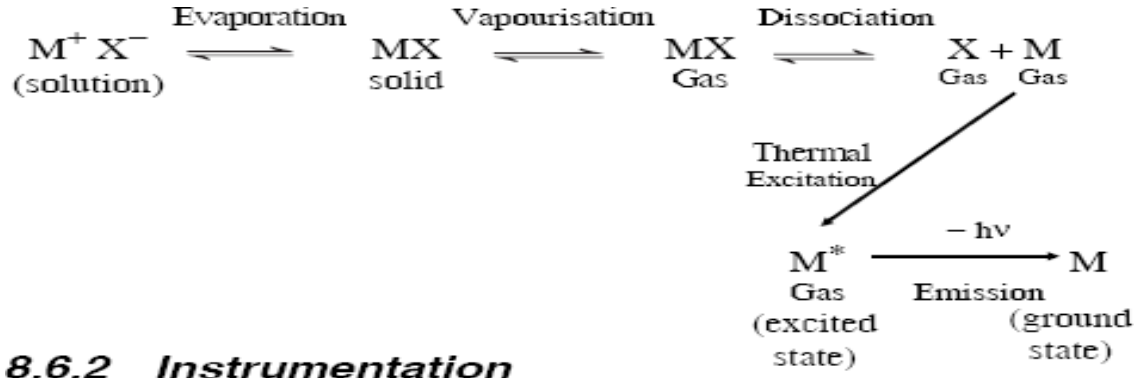
When a metallic salt solution is introduced into a flame, the following processes will occur.

•The solvent is evaporated leaving behind the solid salt particle.

•The salt is vapourised into the gaseous state and dissociated into atoms.

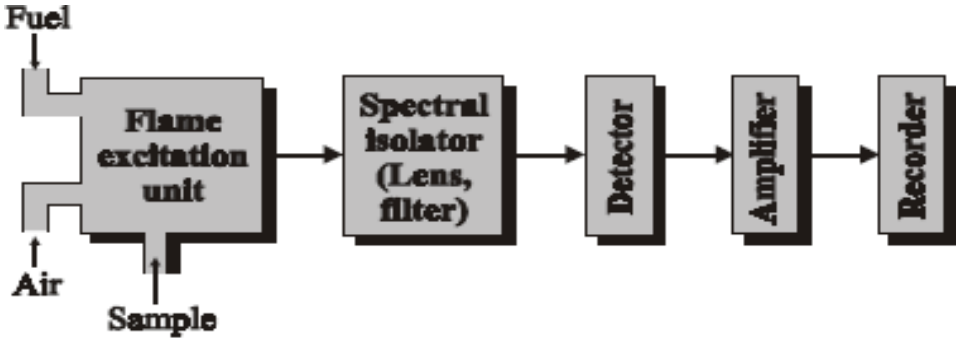
•Some of the atoms from the ground state are excited to higher energy state by absorbing thermal energy from the flame.

The excited atoms, which are unstable, quickly emit photons of different wave lengths and return to the lower energy state. Then the emitted radiation is passed through the filter, which permits the characteristic wavelength of the metal under examination. It is then passed into the detector, and finally into the recorder.



8.6.2 Instrumentation

The various components of the flame photometer are described as follows.



1. Burner

The flame must possess the following characteristics.

(i) It should evaporate the solvent from the sample solution.

(i) It should decompose the solid into atoms.

(i) It should excite the atoms and cause them to emit radiant energy.

2. Mirror

The radiation from the flame is emitted in all directions in space. In order to increase the amount of radiation reaching the detector, a convex mirror is used which is set behind the burner.

3. Slits

***Entrance slits*:** It is kept between the flame and monochromator. It permits only the radiation coming from the flame and mirror.

Exit slit: It is kept between the monochromator and detector. It prevents the entry of interfering lines.

4. Monochromator (Prism (or) Grating (or) Filter)

It allows the light of the required wave length to pass through, but absorbs the light of other wavelengths.

5. Detector

The radiation coming out from the filter is allowed to fall on the detector, which measures the intensity of the radiation falling on it. Photo multiplier (or) photocell is used as detector, which converts the radiation into an electrical current.

6. Amplifier & Recorder

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

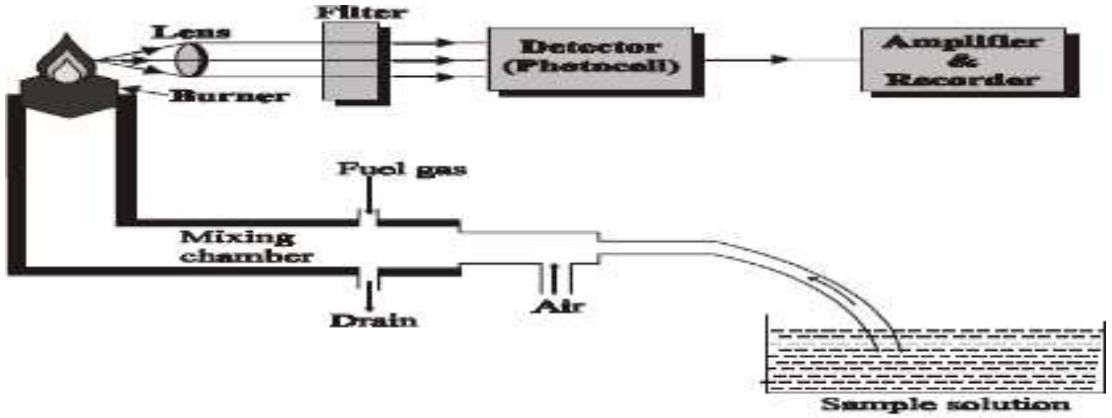
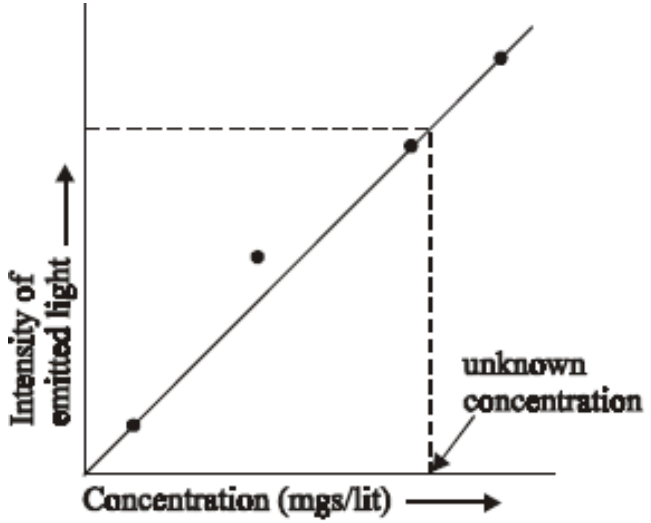


Fig. 8.4 Layout of a simple flame photometer

Working of Flame photometer

- Air, at a given pressure, is passed into an atomizer. The suction so-produced draws some solution of the sample into the atomizer.
- Air + sample solution is then mixed with fuel gas in the mixing chamber. The Air + sample solution + fuel gas mixture is then burnt in the burner.
- The radiation, emitted by burner flame, is passed successively through the lens, filter, detector, amplifier and finally into a recorder.
- The above experiment is first carried out using a series of standard solution, and the reading for each solution is noted. Now the graph, called calibration curve, is drawn between concentration vs intensity of emitted light (or) photometric reading.
- Now the test solution (unknown) is taken and similar experiment is carried out. From the graph the concentration of the unknown sample can be determined.



Applications of flame photometry

1. Estimation of sodium by flame photometry

- The instrument is switched on. Air supply and gas supply are regulated. First distilled water is sent and ignition is started.
- After the instrument is warmed up for 10 min, the instrument is adjusted for zero reading in the display.
- Since sodium produces a characteristic yellow emission at 589 nm, the instrument is set at λ = 589 nm and the readings are noted.
- A series of standard NaCl solution (1, 2, 3, 4, 5 ... 10 ppm) is prepared and is sent one by one and the readings (intensity of emitted light) are noted.
- The calibration graph is drawn between the concentration Vs intensity of the emitted light. A straight line is obtained