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Determination of Sodium content in the Marina beach water using Flame Photometry

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Abstract: Flame photometry is a branch of atomic emission spectroscopy in which the species examined in the spectrometer in the form of atoms.When a dilute solution of the sodium chloride is aspirated into the flame, then a series of process take place. The small droplets evaporate quickly to leave behind smaller solid particles which fuse and evaporate into free atoms. These atoms absorb heat and get excited to high energy level emitted state. This emitted state is unstable and hence return to original ground state and achieve stability. While doing so, they emit the radiant energy which is recorded.This is the basis for flame photometric determination. The Marina beach water sample was collected taking all necessary precautions and analysed in the laboratory for its sodium content.
Key words: Determination of Sodium content, Flame Photometry.

Introduction[1-9]

Flame photometry was devised by Barnes et al. Flame photometry is a simple, relatively inexpensive, high sample throughput method used for clinical, biological, and environmental analysis. Analysis of alkali and alkaline earth metals can be carried out using Flame photometry. Flame photometry can be used for both qualitative and quantitative analysis. Flame photometry can also be used for the determination of certain transition elements like copper, iron and manganese. The atoms under investigation are excited by light. Emission techniques measure the intensity of light that is emitted as electron return to the lower energy level. The flame photometer is relatively simple instrument (**Fig.1**).

There is no need for source of light, since it is the measured constituent of the sample that is emitting light. The energy that is needed for the excitation is provided by the temperature of the flame (2000-3000^{0}C), produced by burning of acetylene or natural gas in the presence of air or oxygen. By the heat of the flame and the effect of the reducing gas (fuel), molecules of the sample species are decomposed and reduced to give atoms. The most sensitive parts of the instrument are the aspirator and the burner. The gases play an important role in the aspiration. The air sucks up the sample and passes it into the aspirator, where the bigger drops condense and could be eliminated. The monochromator selects the suitable characteristic wavelength of the emitted light. The emitted light reaches the detector. The detector is a photomultiplier producing an electric signal proportional to the intensity of emitted light (**Fig.2**).

Fig.1. Photograph of Flame Photometer

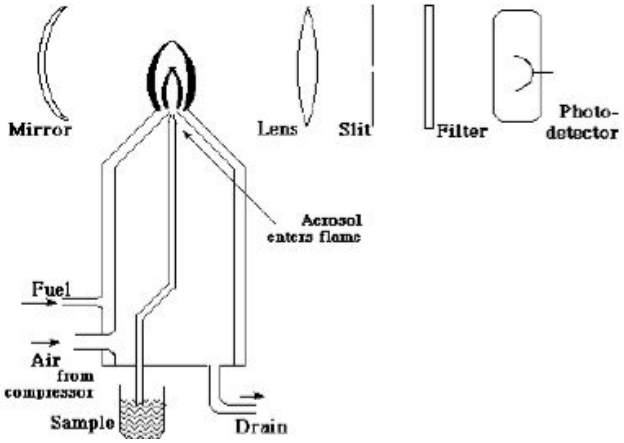

Fig.2. Principle of Flame Photometer

Principle[1-9] **:** It is based on the principle that each element has different energy levels and hence when the elements are excited by flame, they emit radiation on attaining the ground state. The emitted radiations are characteristic of elements. For example,

Element	Wavelength (nm)	Colour
Potassium, K	786	Lilac/Purple
Sodium, Na	589	bright Yellow-orange
Strontium, Sr	460	Scarlet Red
Barium, Ba	553	Green/Yellow

The intensity of the colour tells about the amount and type of the colour about the nature of the element introduced into the flame. When a dilute solution of the sodium chloride is aspirated into the flame, then a series of process take place. The small droplets evaporate quickly to leave behind smaller solid particles which fuse and evaporate into free atoms. These atoms absorb heat and get excited to high energy level emitted state. This emitted state is unstable and hence return to original ground state and achieve stability. While doing so, they emit the radiant energy which is recorded. This is the basis for flame photometric determination. An attempt has been made to report the analysis of sodium in Marina beach water. The water sample was collected in the month of October 2007 and immediately its pH and temperature were noted on the spot. The water is then brought to laboratory. A series of known concentrations of sodium chloride solutions were prepared in mg/l using distilled water. When the series of solutions are introduced to the flame changes to bright yellow-orange (**Fig.3**) and the readings were noted. Then the Marina water sample is aspirated and reading was recorded which is shown in **Table 1**. The calibration curve is plotted (concentrations Vs recording) and a straight line was obtained, from which the concentration of unknown sample can be calculated.

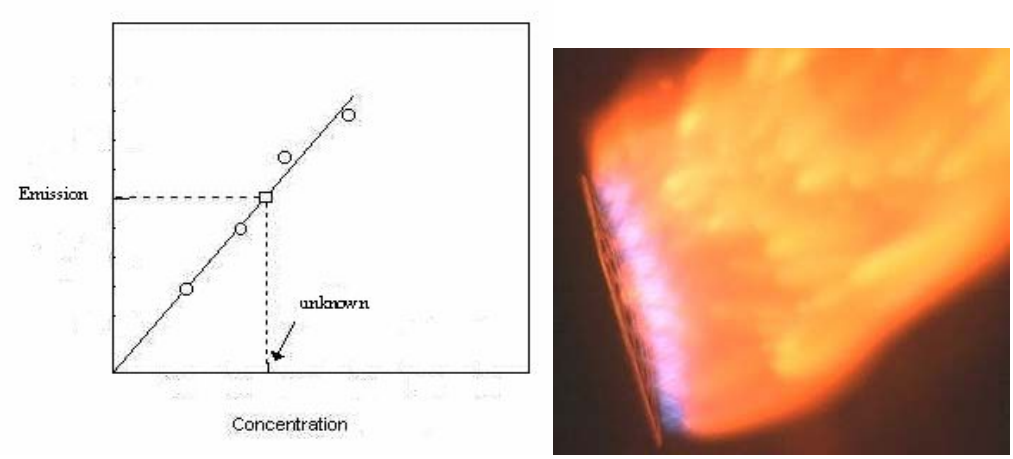

Fig.3. Flame colour of Sodium

Estimation of Sodium in water sample:

2.54g of Sodium chloride is dissolved in one litre of water so that one ml of the solution contain 1mg of sodium. The solution is diluted to prepare standard solutions of varying strengths like 10-60 ppm. The solvent is introduced into the flame and the emission intensity is adjusted to zero. Then the standard solutions are introduced into the flame and emission intensities are measured at 589 nm. The solution of sodium of Marina beach water sample is then introduced into the flame and emission intensities is measured. A calibration graph with emission intensities on Y-axis and concentration on X-axis is drawn. The solution of Sodium of unknown concentration in the Marina beach water sample is now aspirated into the flame and its emission is measured. Using the tabulated values, calibration graph is drawn and the concentration of the solution can be found out.

Table 1. Determination of Sodium content

Concentrations (ppm)	readings
10	38
20	69
30	73
40	84
50	93
60	107
Unknown sample	79

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