

# Determination of the concentration of potassium ion using Flame Photometry

## AIM-

The aim of the experiment is to determine concentration of potassium ion using Flame Photometry (atomic emission spectrometry).

## BACKGROUND-

Flame photometry is also known as atomic emission spectrometry. When a solution containing cations of sodium and potassium is sprayed into flame, the solvent evaporates and ions are converted into their atomic state. In the heat of the flame (temperature about 1800°C), small fraction of the atoms is excited atoms to the lower energy level are accompanied by emission of light (photons) with characteristic wavelength (Na: 589 nm, K: 766 nm). Intensity of the emitted light depends on the concentration of particular atom in flame.

The wavelength of the UV radiation is then measured. Relative precision and accuracy can be expected to be between  $\pm 1-5\%$  because of the characteristic emission lines from the gas phase atoms in the flame plasma, which eliminates interferences most other elements. Since there are many experimental variables affecting the intensity of the light emitted from the flame, the result must be calibrated.

## REQUIREMENTS-

**Instruments:** Flame photometer

**Reagents:** Stock solutions of K

**Glasswares:** 7 nos. of 50 ml volumetric flasks.

Glass pipettes: 10 ml

Measuring cylinder: 50 ml

## PROCEDURE-

### Solution preparation-

#### Stock KCl solution (1000 ppm K):

It is prepared by accurately weighing 1.908 g of analytical grade KCl and dissolving in about 200ml of distilled water taken in a volumetric flask of 1 litre capacity and adding sufficient distilled water to make up to the the mark.

#### Stock KCl solution (100 ppm K):

It is prepared by taking 10 ml of the stock solution of KCl (1000 ppm) in a 100ml volumetric flask and diluting it to the mark with distilled water.

About 0.0, 5.0, 10.0, 15.0, 20.0, and 25.0 ml respectively of the standard 100 ppm  $K^+$  ion solution are taken in a series of 50ml volumetric flasks labelled from Nos. 1 to 6. The volumes of the solutions are made up to the mark with distilled water to obtain standard solutions of 0, 10, 20, 30, 40 and 50 ppm K solutions. The instrument is calibrated by aspirating these solutions in the flame.

The operating instructions should be carefully read provided with the instrument and may be discussed the same with the counsellor before handling the

instrument. In another 50 ml flask, labelled as 'Sample', 25 ml of the unknown sample is taken and diluted up to the mark. The standard solutions are aspirated as well as the sample solution one by one into the instrument three times each in decreasing conc. order and recorded the readings (intensity) for the  $K^+$ .

More accurate intensity of the K ions, for the standard as well as the sample solution are calculated from the mean value of each data and recorded the same in the column of the observation Table. A graph is plotted between the concentrations of the standard  $K^+$  ion (on the X-axis) versus the intensity of the  $K^+$  ion (on the Y-axis). The concentration of the given sample solution is determined with the help of the calibration curve. The actual concentration of the potassium ions present in the unknown sample solution is calculated by accounting for the dilution factor and the value is reported.

[Note: The emission intensity results can be presented as percentages. This can be done by calibrating the photometer with 0 ppm (blank) = 0 reading and 50 ppm (highest concentration) = 100 reading.]

## OBSERVATIONS AND CALCULATIONS-

### A. Collection of emission intensity data for the standard and sample solutions:

| 1<br>Flask<br>number | 2<br>Vol. of 100 ppm standard $K^+$ or<br>sample sol. (ml) | 3<br>Vol. of distilled<br>water (ml) | 4<br>Conc. of standard $K^+$<br>sol. (ppm) | 5<br>Intensity of the $K^+$<br>ion signal |   |   |      |
|----------------------|--|--------------------------------------|--|---|---|---|------|
|                      |  |                                      |  | 1   | 2 | 3 | Mean |
| 1                    | 0  | 50                                   | 0  |   |   |   |      |
| 2                    | 5  | 45                                   | 10   |   |   |   |      |
| 3                    | 10   | 40                                   | 20   |   |   |   |      |
| 4                    | 15   | 35                                   | 30   |   |   |   |      |
| 5                    | 20   | 30                                   | 40   |   |   |   |      |
| 6                    | 25   | 25                                   | 50   |   |   |   |      |
| Sample               | 25   | 25                                   | ?  |   |   |   |      |

### B. Plotting the calibration curve:

A graph between the mean of the  $K^+$  ion signal on Y-axis and the concentration of standard  $K^+$  ion on X-axis is plotted.

### C. Determination of the conc. of the $K^+$ ion in the sample from calibration curve:

Concentration value of the sample solution is obtained in ppm, extrapolating cross section point of calibration curve and the intensity of the  $K^+$  ion signal of sample towards X-axis.

Let the concentration of K ion in the sample solution obtained from the graph = P ppm

The actual concentration of K ion in the sample solution would be:

=  $P \times 2$  ppm

= .....ppm (As the sample solution was diluted to 2 times, the actual concentration of  $K^+$  ion should be obtained by multiplying the concentration obtained from the graph by 2.)

### **CONCLUSION-**

The concentration of  $K^+$  ion in the given sample solution = ... ppm

### **REFERENCES-**

1. CHE226 Lab Handout, Exp 9 Flame photometric Analysis of Sodium
2. D. A. Skoog, D. M. West, F. J. Holler, and S. R. Crouch, Analytical Chemistry: An Introduction, 7<sup>th</sup> edition, chapter 23, Page No. 594.