**Absorption coefficient calculation of Potassium chromate (k2CrO4) solution**

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**ABSTRACT**

Absorption coefficient calculations of Potassium chromate (k2CrO4) by the analysis of absorption spectrum using Double Beam UV/VIS Spectrophotometer and plotted the graph between wavelength vs absorbance and concentration vs absorption coefficient. The cuvette contained distilled water in reference cell, measured absorbance at different wavelength using the cuvette which contained Potassium chromate of concentration .207 mole/litrin Sample cell. The concentration of Potassium chromate determined at wavelength 626 nm.

**Keyword**: Double Beam UV-Visible Spectrophotometer

**INTRODUCTION**

It is the branch of science dealing with the study of interaction between Electromagnetic radiation and matter. It is most powerful tool available for the study of atomic and molecular structures and is used in the analysis of wide range of sample1-2. All known frequencies and their wavelength of electromagnetic radiation or photon known as electromagnetic spectrum. Electromagnetic spectrum is the specific distribution of electromagnetic radiation according to frequencies and wavelength3. The Electromagnetic wave have wide range of frequencies, wavelength and photon energies and electromagnetic wave travel with a speed of light in a vacuum. Till the 20th century, it was believed by most physicists that this spectrum was infinite and continuous. The most important and interesting aspects of spectroscopy are study the propagation of light through matter4. For characterize matter and its study all types of electromagnetic radiation can be used in spectroscopy.

Light that is passes through the substance, a particular wavelength is absorbed. The rate of absorption of light is proportional to the intensity for a given wavelength. In other words, as light passes through the substance, the intensity is decrease by the fact that some are absorbed on the path through. Therefore the intensity that reach a certain point in the substance depends on the wavelength and travelled distance5. The absorption coefficient decide how far a particular type of light wave can travel through a particular substance before it is absorbed. A substance which has low absorption coefficient absorbs less wavelength of light. If the substance is so thin, it appears transparent to that particular wavelength. The absorption coefficient depends on the material and also on the wavelength of light which is being absorbed.

In this paper the absorbance and concentration of Potassium chromate solution is measured. Absorption coefficient is calculated using absorbance and plotted the graph between concentration vs absorption coefficient and result is discussed.

**Potassium chromate Properties**

The potassium chromate is oxidizing agent

Appearance: Powder, contain yellow color

Chemical formula: K2CrO4

Molar Mass: 194.19 g.mol-1

Boiling point: 1,000 °C (1,830 °F; 1,270 K)

Density: 2.7320g/cm3

Melting Point: 968 °C (1,774 °F; 1,241 K)

Magnetic Susceptibility: −3.9 x 10−6 cm3/mol

Refractive Index: 1.74

Crystal Structure: Rhombic

**Absorption coefficient calculations**

The absorption coefficient α is calculated from UV-Vis absorbance data , According to beer lambert law, the transmitted intensity is equal to the exponentially decaying incident intensity. If x is the thickness of the solution or length of cuvette through which the intensity is passing. By taking the log of both sides and utilizing this logarithmic relation which is equal to –α x loge, put value of loge is .4343. the term Log(Io/I) is called absorbance A, So applying this logarithmic relation, absorbance is equal to αx times .4343. Putting x = 1 cm as dimension of a length of cuvette. Thus from the UV-Vis absorption data. The columns in the table 1.1 shows the wavelength, absorbance and absorption coefficient6 .

From lambert law

I = Io e-αx

I/Io = e-αx

log(I/Io) =log(e-αx ) = -αxlog(e) = -αx(.4343) where loge =.4343

log(Io/I) = A = αx(.4343)

α =2.302 A/x length of cubette x = 1 cm

So absorption coffcient α = 2.302 A cm-1

**Molarity** **Calculations**

Molar concentration is known as Molarity. The Molarity is the ratio of the

number of moles of a substance and total volume of solute plus solvent. The

volume of the solution is used in litre. The unit of the Molarity is mole per litre.

Wavelength range = 396 -700 nm

Molecular weight of potassium chromate = 194.1926 gm

Quantity taken (potassium chromate) = 2.51 gm

Water (distilled) = 60 ml

Weight of solution = 62.51 ml = .06251 litre

Molarity =

No. of moles = = 0.01292

Molarity = x 1000

= 0.207 mole/litr

**Concentration calculations**

Concentration and molarity are two important terms, these both the terms are used to indicate quantitative measurement of a substance.

Molarity is a way of expressing the concentration. The difference between concentration and molarity is that the concentration is the content of solutes in solution where as the molarity is the method of expressing the concentration of a solution.

To evaluate the concentration of the solution, the solution is diluted with water in different compositions and the total volume is taken 5ml. The molarity of solution is .207 mole /litre. The relation between molar concentration and volume m1v1 = m2v2 is used to calculate the concentration of mixed solution and values are tabulated.

**OBSERVATION**

**TABLE 1.1 Absorbance and Absorption coefficient**

**for different values of wavelength**

|  |  |  |
| --- | --- | --- |
| Wavelength(nm) | Absorbance | Absorption coefficient  α = 2.302 A/x cm-1 |
| 396 | 0.0031 | .0071362 |
| 419 | 0.002 | .004604 |
| 442 | 0.000 | .000 |
| 465 | 0.002 | .004604 |
| 488 | 0.0021 | .009208 |
| 511 | 0.003 | .006906 |
| 534 | 0.004 | .009208 |
| 557 | 0.0031 | .0071362 |
| 580 | 0.003 | .006906 |
| 603 | 0.0039 | .0089778 |
| 626 | 0.006 | .013812 |
| 649 | 0.003 | .006906 |
| 672 | 0.002 | .004604 |
| 695 | 0.000 | .000 |

Wavelength fixed = 626 nm,

Maximum wavelength= 700 nm

Total solution taken = 5ml

**TABLE 1.2 absorbance&absorption cofficient for different Concentration of the solution**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Solution(ml)** | **Water**  **(ml)** | **Absorbance** | **Absorption coefficient** | **Concentration**  **(final)** |
| 1 | 1 | 4 | 0.040 | .0928 | 0.041 |
| 2 | 2 | 3 | 0.041 | .094382 | 0.082 |
| 3 | 3 | 2 | 0.042 | .096684 | 0.124 |
| 4 | 4 | 1 | 0.043 | ,098986 | 0.166 |

**Results**

The light intensity absorbed by the substance is dictated by the concentration of that substance. Absorption coefficient is decreases as the concentration is decreased .The light is poorly absorbed in a substance if the absorption coefficient is low, and if the substance is thin enough, it will appear transparent to that wavelength. At wavelength 626 nm maximum Absorbance is 0.006 and maximum absorption coefficient is .013812. From Table 1.1 & figure 1.1 we get two maxima one at 534 nm for which absorbance is 0.004 and other one at 626 nm for which absorbance is 0.006 and combination of both absorbance will be . The values of absorbance and absorption coefficient for varius concentrations are measured at wavelength 626nm. From table1.2 &figure1.2 shows that absorption coefficient increases linearly with concentration for a fixed wavelength 626 nm in the solution.

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