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

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**ABSTRACT**

The concentration and absorption coefficient of potassium chromate (k2CrO4) were plotted on a graph along with wavelength and absorbance using a double-beam UV/VIS spectrophotometer to analyze the absorption spectrum. Utilizing a cuvette containing concentrated potassium chromate and distilled water as a reference, absorbance was measured at various wavelengths.Sample cell contains .207 moles per liter the amount of potassium chromate as measured at 626 nm in wavelength.

Keyword: Dual Beam UV-Visible Spectrophotometer

**INTRODUCTION**

The study of how electromagnetic radiation and matter interact is the focus of this scientific field. It is the most potent tool currently available for studying atomic and molecular structures and is employed in the analysis of a variety of sample 1-2. The electromagnetic spectrum is the collection of all observed frequencies and photon wavelengths. According to frequencies and wavelengths, electromagnetic radiation is distributed specifically in the electromagnetic spectrum3. Numerous frequencies, wavelengths, and photon energies are included in electromagnetic waves. In a vacuum, they move at the speed of light. Most physicists up until the 20th century thought this spectrum was infinite and continuous. The study of light propagation through matter is the most significant and fascinating aspect of spectroscopy4. In spectroscopy, all forms of electromagnetic radiation can be used to describe matter and study it. Light that is passes through the substance, a particular wavelength is absorbed. For a given wavelength, the intensity and rate of light absorption are inversely related. In other words, because some light is absorbed as it travels through the substance, the intensity of the light decreases. Because of this, the wavelength and distance traveled affect the intensity at a given point in the substance5. How far a specific type of light wave can pass through a substance before it is absorbed depends on the absorption coefficient. A substance with a low absorption coefficient absorbs light at a lower wavelength. It appears transparent to that particular wavelength if the substance is that thin. The wavelength of the light being absorbed as well as the material have an impact on the absorption coefficient.

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 , The transmitted intensity is equal to the incident intensity's exponentially decaying intensity, according to Beer's Law of Lambert. If x represents the solution's thickness or the length of the cuvette through which the intensity is moving. By combining the logarithms of the two sides and using this relationship, 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 ratio of a substance's moles to its total volume, including both the solute and the solvent, is known as its molarity. It is customary to use litres to measure solution volume. The mole per litre is the unit of molarity.

Wavelength range = 396 -700 nm

Potassium chromate's Molecular weight = 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. The expression of concentration through molarity. The difference between concentration and molarity is that the former refers to the amount of solutes in a solution while the latter is a way to express concentration. 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 concentration of the substance determines the amount of light it can absorb. 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.

According to Table 1.1 and Figure 1.1, there are two maxima: one at 534 nm, where absorbance is 0.004, and another at 626 nm, where absorbance is 0.006. The sum of the two absorbances is then equal to . The values of absorbance and absorption coefficient for varius concentrations are measured at wavelength 626nm. From table1.2 &figure1.2 shows that for a constant wavelength of 626 nm in the solution, the absorption coefficient rises linearly with concentration.

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