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Effect of Increasing The Concentration Of $KAl(SO_4)_2.12H_2O$ On Some Optical Properties Of The Solutions Prepared

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Abstract:

Some of optical properties of $KAl(SO_4)_2.12H_2O$ dissolves in distilled water had been studied at different concentrations (0.05% , 0.075% , 0.1% , 0.125 and 0.15 gm./ml). The optical properties had been measured which included measuring absorbance by using (Double-Beam Spectrophotometer (UV-1800)) and refractive index by using refractometer and from these two properties other properties were calculated such as: reflectance, transmittance , coefficient of fineness, critical angle and brewster angle. The results showed that all these properties have increment with the increase of $KAl(SO_4)_2.12H_2O$ concentration except that critical angle was decreased with increasing of $KAl(SO_4)_2.12H_2O$ concentration. Also, the absorbance values for the wavelength were studies and noticed it is observed that the values of the absorbance decrease with increasing wavelength.

Keywords: $KAl(SO_4)_2.12H_2O$ solution, optical properties, Refractometer, (Double- Beam Spectrophotometer (UV-1800)).

1. Introduction:

This material is used in many industrial fields that are related to human life, it can be used as a purifying factor for irrelevant objects that are found in drinking water as it (i.e. crystal) melts with water thus producing Tri- Alominium Ion which forms a hydroxide with water having a foam –like quality that causes the irrelevant objects in water to go down the water container, thus it can be removed by mechanical methods [Martin S.Silberberg].

In addition to the above uses, the crystal is used as a purifying factor for injuries and it helps to keep the skin in a smooth condition in certain illness conditions or surgeries. It can also be used to produce Alominium that is an important factor in making parts of airplanes and as an element in producing Alomia (Alominium oxide) that is used as a dying element for satellite dishes and other similar objects (Raymond change 1993).

The purpose of this research was to investigate the optical properties of $KAl(SO_4)_2$. $12H_2O$ as aqueous solutions by (Double-Beam Spectrophotometer (UV-1800)) and refractometer and know its ability to industrial applications.

2. Experimental:

1.2 Preparation of Solutions:

The researcher prepared $KAl(SO_4)_2.12H_2O$ with assay (99.8%) and different solutions were prepared by dissolving known weights of the $KAl(SO_4)_2.12H_2O$ powder in affixed volume (500 ml) of distilled water under stirring for (10 min). The $KAl(SO_4)_2.12H_2O$ concentrations were (0.05% , 0.075% , 0.1% , 0.125 and 0.15 gm./ml). The resulting solution was stirred continuously for (10 min) until the solution mixture became homogeneous.

2.2 Spectrophotometer:

Absorbance and transmittance were measured using a device to measure Spectrophotometer factory of the company (Shemadzo) Japanese type (Double-Beam Spectrophotometer (UV-1800)) as shown in Figure (a), which range from wavelengths where (190-1100)nm, a programmer computerized to carry out the survey for all wavelengths and give wavelength that occurs which has a maximum absorbance and less transmittance.

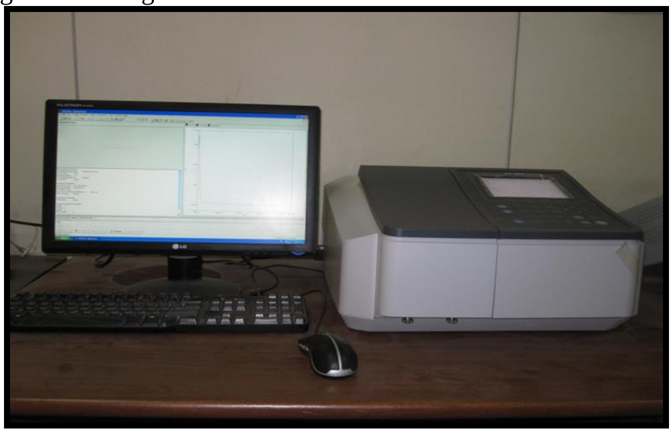

Figure (a) Spectrophotometer device

3.2 Refractometer:

Refractive index was measured using a device to measure the refractive index type (Abbe-13743) factory of the company (ZEISS) as shown in figure (b), where this device measures the refractive index solutions which refractive index ranges between (1.3-1.7) and that the proportion of error in the device is equal to (± 0.0002)

Figure (b) Refractometer device

3. Theoretical calculation:

In the theoretical part the reflectance (R) is calculated by measuring the refractive index (n) using a refractometer, where the reflectance equation is shown as follows (N.M.Saeed , et al 2012 , J.H. Ibrahim 2009,G.R.Fowels 1975).

$$R = \left[\frac{n-1}{n+1}\right]^2 \quad \textbf{.........................(1)}$$

Transmittance (T) was calculated through measuring the absorbance (A) using a(Double-Beam Spectrophotometer (UV-1800)) and also comes transmittance equation (AL.Bermany ,2012, B.H.F AL-Khayat 1985).

$$T = 1-(A+R) \quad \textbf{.........................(2)}$$

Coefficient of Fineness (F) was investigated by calculating the reflectance, the equation Coefficient of Fineness is shown as follows (S.H.Abd AL-amiree 2003).

$$F = \frac{4R}{(1-R)^2} \quad \textbf{.......................(3)}$$

As for the critical angle (θ_c)was calculated by measuring the refractive index which is shown in the following equation (G.R.Fowels 1975,Youkghoo kim 2004).

$$\theta_c = \mathrm{Sin}^{-1}(1/n) \quad \textbf{.........................(4)}$$

The brewster angle (θ_B)was calculated by measuring the refractive index which is shown in the following equation (S.H.H AL- Nesrawy 2002,Malgosia Kaczmarek 2009,D.K.Avasthi 2007).

$$\theta_B = \tan^{-1}(n) \quad \textbf{........................(5)}$$

4. Results and Discussion:

The absorbance of different concentrations of $KAl(SO_4)_2.12H_2O$ were studies where a curved graph was drawn between the values of the wavelength and Absorbance within the range of (200-1100)nm and the results are shown in figure (1) and through it, it can be seen that the highest value of the absorbency can be seen when the wavelength is between (230-240)nm and peaking at a wavelength (240 nm), the wavelengths higher than that becomes then the KAl $(SO_4)_2.12H_2O$ solutions force of light and the reason for that was that to increase the wavelength of the light falling lead to decrease the energy of light and thus absorbance decreases according to the law Planck.

The change absorbance optical focusing of KAl $(SO_4)_2.12H_2O$ solutions wavelength (240 nm) illustrated in figure (2) through it we can observe the increasing values of absorbance due to the steady increase of the concentration where it is directly proportional to the absorbance according to the law of Lambert Beer (G.R.Fowels 1975, Malgosia Kaczmarek 2009, D.K.Avasthi 2007,Wieslaw W.sulkowski 2008).

Density was measured for all solutions of KAl $(SO_4)_2.12H_2O$ and the results are shown in Figure (3), in this is which increases the density values with increasing concentration of KAl $(SO_4)_2.12H_2O$ and caused due to the increased mass of the solution as a result of solubility in distilled water.

Refractive index was measured practically for all solutions at the wavelength (240 nm) and the results are shown in Figure (4), as it shows that the values of the refractive index increase with increasing concentration of the solutions KAl $(SO_4)_2.12H_2O$ and the reason for that goes back to that when you increase the concentration the value of density increases and density is a function of the task to calculate the refractive index so increasing the values of the refractive index increased emphasis (S.Srivastava 2008).

Reflectance values are found for all solutions of equation (1) and these values increase with increasing concentration at the wavelength (240 nm), as shown in Figure (5) The reason for this is due to the increased number of molecules in solution and therefore increase the density of the solution as the specularity completelydependentondensity.

Figure (5) shows that the values of reflectance vary linearly with increasing concentration and can be explained on the basis of the adoption of reflectance on the refractive index by the relationship (1). Therefore, the reflectance behaves similary to the refractive index.

The values of transmittance were found for all concentrations of the relationship (2) a curved graph between the values of the concentration and the transmittance and Figure (6) shows the results of increasing the values of transmittance with concentrations due to the decrease absorbance with the concentrations of the fact that the transmittance and absorbance relationship is logarithmic.

The coefficient of fineness for solutions is found through equation (3) and the results of increasing the coefficient of fineness with an increased concentration illustrated in Figure (7). Because of the increased amount of light reflected as a result of increased density with increasing concentration.

Figure (8) shows that the critical angle of an inverse relationship with the refractive index, any increase in the refractive index causes a decrease in the critical angle.

Brewster angle values depend mainly on the values of the refractive index positive relationship with the refractive index and the figure (9) shows that the Brewster angle increases with increasing concentration and the reason for this is due to the increase in refractive index with an increased concentration (S.Srivastava 2008,Michael Mainil 2003 ,Traian Zaharescu 2008,Danuta Sek 2004, Ajipuor , Saeed Zahmatkesh 2008).

5. Conclusions:

1. In this study, it is found that these solutions show a continuous change in their optical properties with increasing concentration.

2. It is observed that the highest value for the absorption of electromagnetic radiation are located within the area of the spectrum (UV) within the range (230-240) nm while implementing these rays in other regions of the spectrum. Can be considered as a good absorbent material to ultraviolet waves (UV) and thus can be used Kogtih proof sunlight and preventing the arrival of ultrasonic radiation in cases of any storage materials that are affected by this kind of waves.

3. Can using solutions for the manufacture of sunglasses because the transmittance few UV and thus can protect the human eye from the risks of these rays .

4. It is observed that there is an increase reflection electromagnetic radiation in the solution because of the increased density of the solution and thus can be used in the manufacture of various types of glass to protect and reduce the level of solar radiation.

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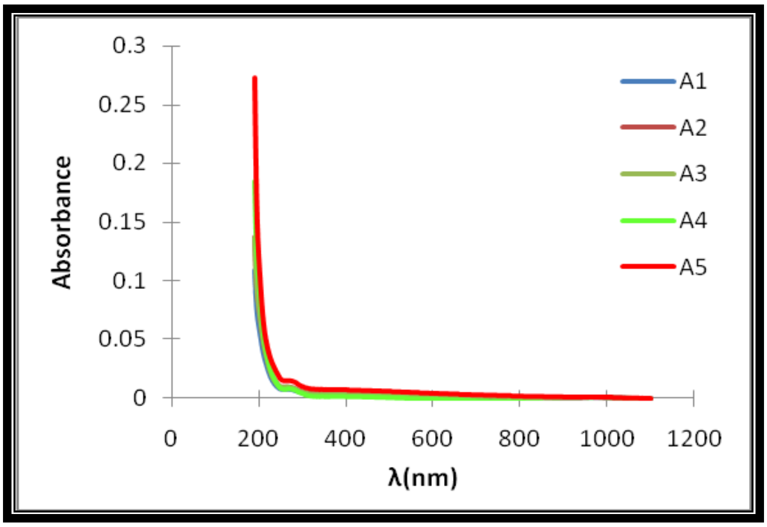

Figure.1. Absorbance due to Wavelength

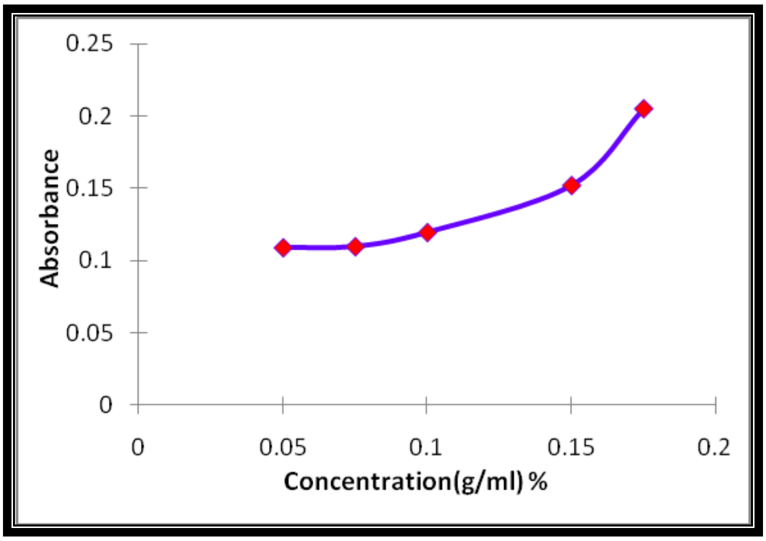

Figure.2. Absorbance due to concentration

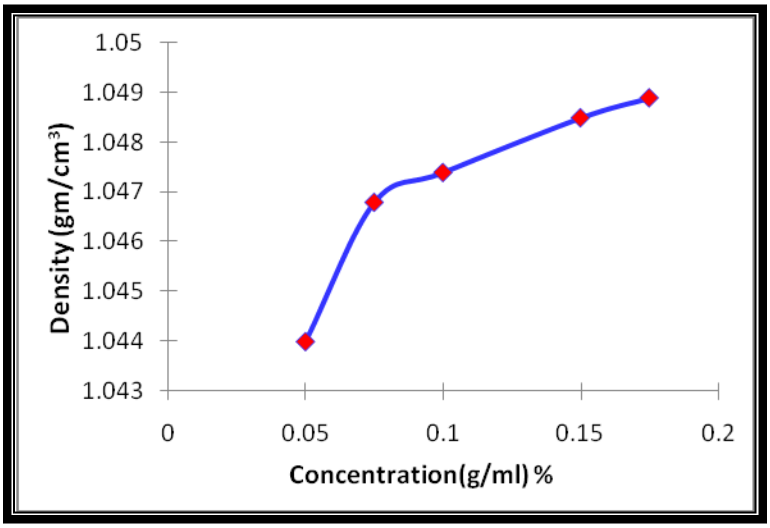

Figure.3. Density due to concentration

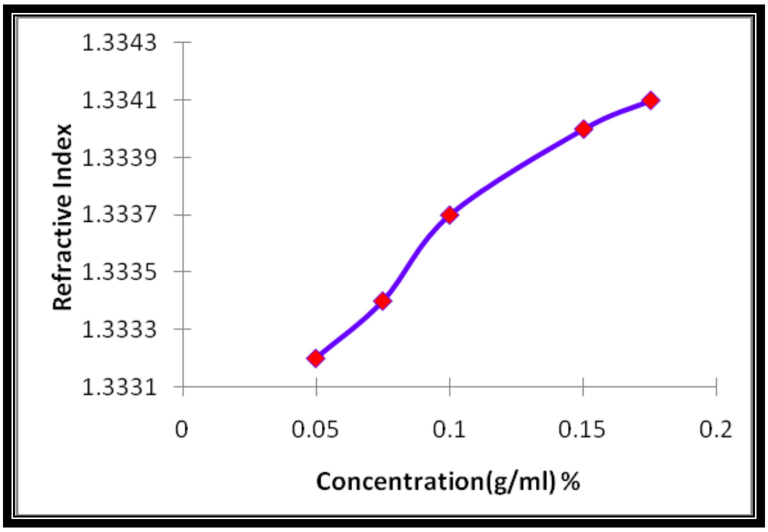

Figure.4. Refractive index due to concentration

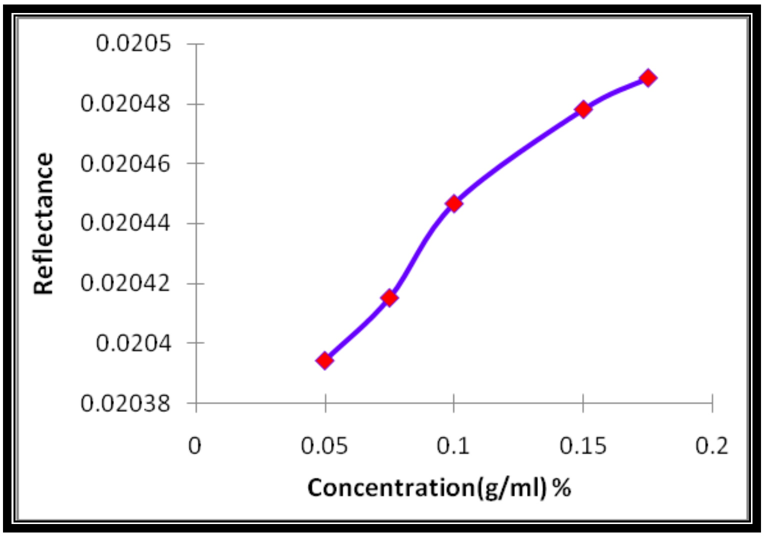

Figure.5. Reflectance due to concentration

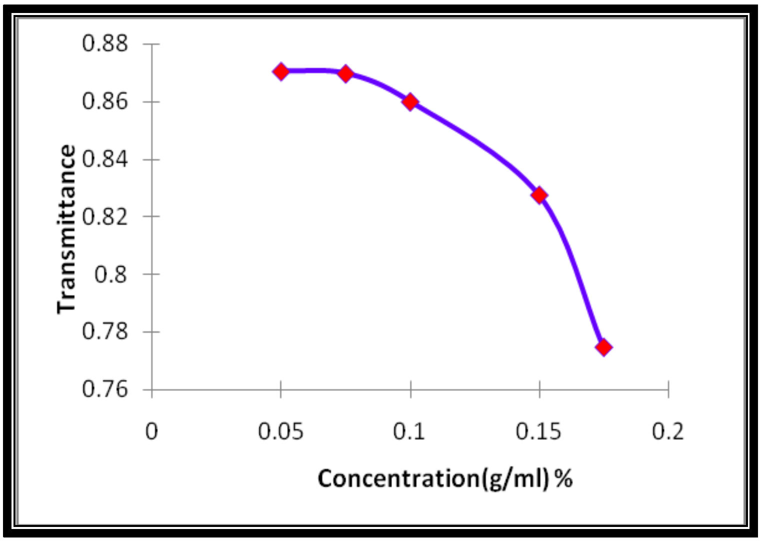

Figure.6. Transmittance due to concentration

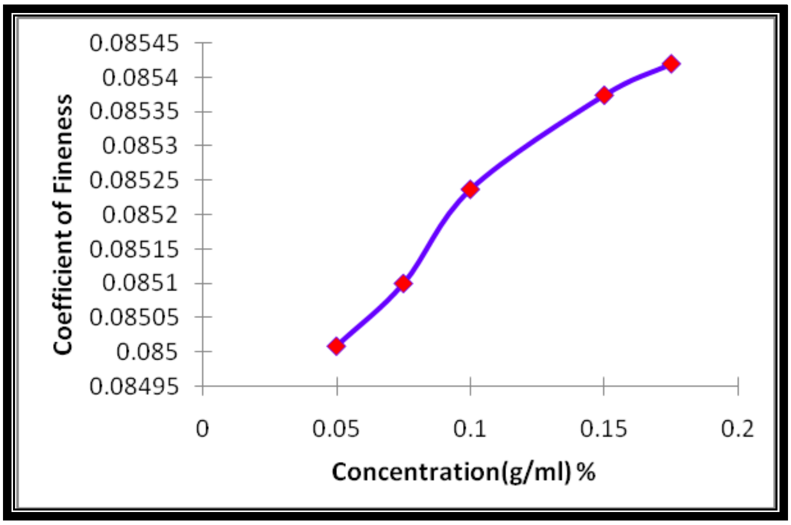

Figure.7. Coefficient of fineness due to concentration

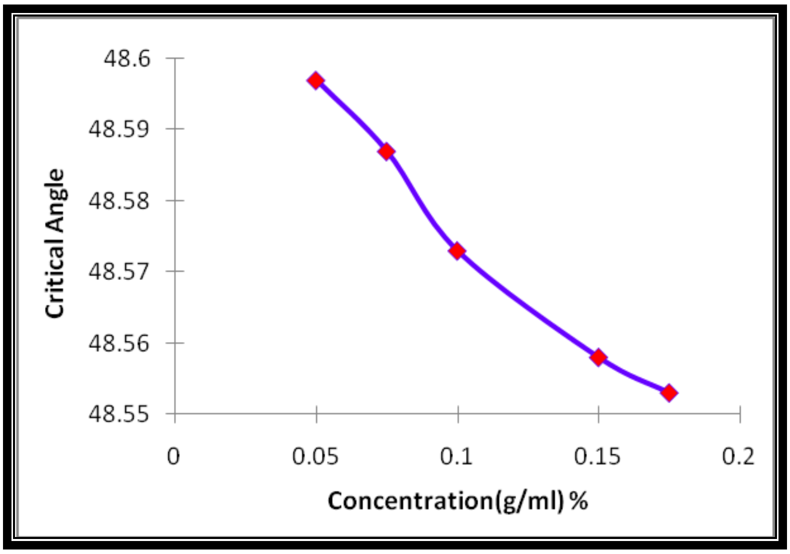

Figure.8. Critical Angle due to concentration

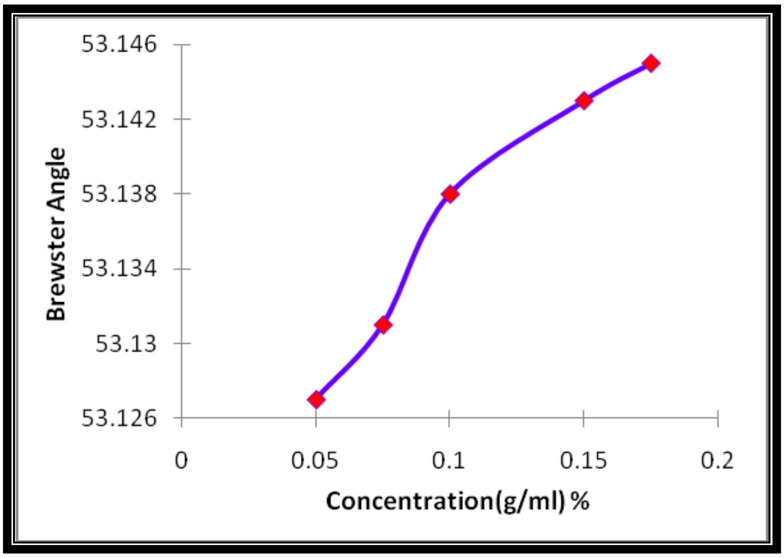

Figure.9. Brewster Angle due to concentration