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Adsorption Isotherm Study of Vitamin B2 on Carbon Nanotube

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ABSTRACT

In this research by equilibrium adsorption isotherms of vitamin B2 (Ribo Flavin) on carbon nano-tubes having the multi wall through several discontinues method has been studied.with the help of spectro photometer (UV / VIS) adsorption chart based on the wavelength of vitamin B2 has been obtained, and the relevant graph is plotted .by considering factor of concentration, the concentration necessary for maximum adsorption of vitamin B2 on carbon nano-tubes and thus the maximum adsorption rate was determined. To attract the highest concentration of vitamin B2 is 10ppm which is fitted to experimental vitamin B2 absorption using several models performed. The results of experiments with models Freundlich, Langmuir, and Temkin were conducted and various parameters of this model for adsorbing carbon nano-tubes obtained. According to the error calculated for each model, Freundlich equation compared with other models have the best harmong experimental results.

Key words: Isotherm, Adsorption, Carbon nano-tubes, Vitamin B2.

INTRODUCTION

Multi-wall nano-tubes discovered in 1991 would create incentives for broader research in engineering science based on entirely carbon nano-tubes and their applications[1]. This largely due to the favorable combination of properties such having faultless structure, a small, low-density, high hardness and strength of the carbon nano-tubes. With these characteristics carbon nano-tubes can have broad applications which are allocated to[2]. Hollow nano-structure the tubes may lead to strength and density of a few walls (1/8) and a good resistance against chemicals and having high thermal stability. Nanotube oxidation of the double tube begins that will open tube. Tubes have high capillarity and can solve liquids and gas in itself[7-6]. All compounds on the surface of carbon nano-tubes are adsorbed by two major covalent and non covalent links[3-4]. They can be planted there without causing ulcers in the point and they can release the drugs slowly over the time in the point. The application part of carbon nano tube are: Precise photography of biological, chemical and biological sensors have a reliable and long life, identify and separate customizable DNA, gene therapy through gene transfer into cells by them, removing bacteria and ....[5].

Ribo flavin or vitamin B2 causes the release of energy from carbohydrate, protein and fat. Ribo flavin: for reproduction, growth and repair skin, hair, nails and joints and it is also necessary and important for the safety of the body against disease protection [6]. Considering the role of vitamins in the diet and its importance in energy metabolism on how to attract them much research has been done with extraordinary properties of carbon nano-tubes as vitamin B2 soluble in water which has particular importance.

EXPERIMENTAL

Chemicals materials

Water is distilled twice to prepare vitamin B2 solution. Adsorbent carbon nano-tubes with a diameter of the outer surface nm10-5 space m² / gr600-40 and high purity merk 95% of the company. To produce solutions; water is distilled twice in all experiments .

Adsorption experiment

Solutions used was prepared by solving vitaminB2 and distilled water is used twice..First a solution with concentration of 100 mgL^{-1} prepared then it dilute and different concentrations (10.8.6.4 ppm) have obtained. Certain quantities of carbon nano-tube (0.01 g) have been added as absorbent to 100 mL glasses containing 10 mL vitaminB2 solution, then it was stirred by mixer for 24 hours (optimal time).After mixing process then the solution should be put into 10000 rpm speed for 20 minutes until the solid and liquid phases ara separated. Vitamin concentration was measured before and also after adsorption by atomic absorption machine. All tests have been performed at the lab with the temperature of(C° 2 ± 22)..

DISCUSSION

Table (1) shows the amount of vitamin B2 in the absence of carbon nano-tubes on the solvent distilled water at wavelengths 262/8(262/8= λmax) on the distilled water solvent .

Figure (1) shows the amount of adsorption of vitamin B2 with different concentrations without the presence of carbon nano-tubes with some walls. As was shown with increasing concentrations of vitamin B2 adsorption rate increases so that so that we see the most adsorption in 10ppm by using the diagram (1) and Table (1) kit can be calculated the adsorbed vitamin B2 (0.01 g) on that nano-tube in table (2)

Evaluating isotherm

Freundlich adsorption isotherms

This model often shows homogeneous absorbent non-adapted hub with experimental data[7-8]. Freundlich adsorption isotherms equation is described below:

$$q_e = K_f C_e^{1/n} \quad ...(1)$$

Table 1: The adsorption of B2in absent of carbon nanotube

Concentration vitaminB2 (mgl^{-})	Highest adsorption (nm)
4	0.46
6	0.57
8	0.63
10	0.69

Table 2: The amount of vitamin B2 on 0.01 grams of carbon nano-tubes

Concentration vitaminB2 (mgl^{-})	Material adsorbed on 0.01 grams of carbon nano-tubes (mgg-)
4	2.27
6	2.94
8	3.87
10	4.27

Table 3: Experimental results obtained from the isotherm data

Model	Temkin	Freundlich	Langmuir
	R^2=0.96	R^2=0.78	R^2=0.97
vitaminB2	B=1.74	Q_m=8.92	$\frac{1}{n}$=1.79
	KT=2.05	KL=.16	KF=1.64

q is adsorbate rate in term of $mgg^{-1}$and C_{eq},1/n&k_f are adsorbate concentration into solution at the balance moment, from Freundlich constants respectively. These constants are the adsorption severity and adsorption capacity respectively .The following part shows the linear equation:

$$\ln q_e = \ln K_f + 1/n \ln C_e \quad ...(2)$$

To calculate the constants of Freundlich equation, we draw ($\ln q_e$) curve in term of($\ln c_e$) according to the presented equation (eq.2) .It is found that if its value (slope of this curve -1/n – is greater therefore the adsorption amount is more too. Here are the related diagram in figure 2 and 1/n- k_f parameters at the table 3.

Langmuir model

This model is identical with the energy being adsorbed all the sites on the adsorbent surface obtained [8]. with the following equation

$$q = \frac{q_m b C_{eq}}{1 + b C_{eq}} \quad ...(3)$$

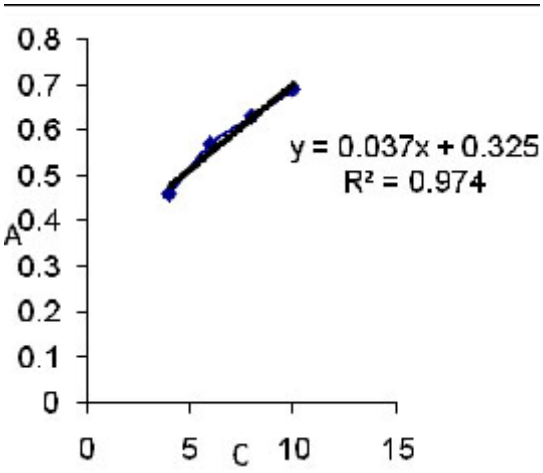

Fig. 1: Adsorption rate without nano-tube vitamin B2

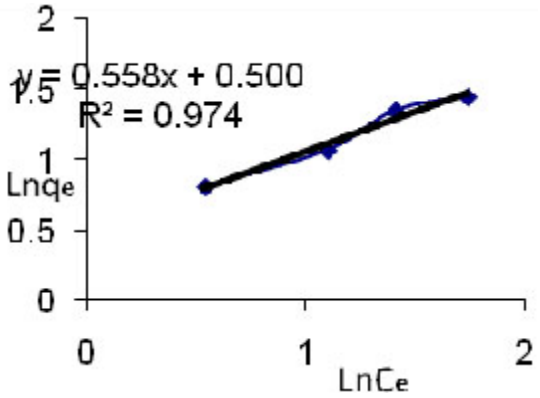

Fig. 2: Vitamin B2 adsorption diagram based on Freundlich

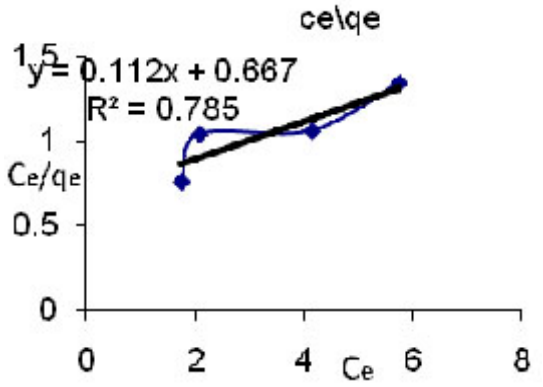

Fig. 3: Adsorption diagram of vitaminB2 based on. Langmuir model

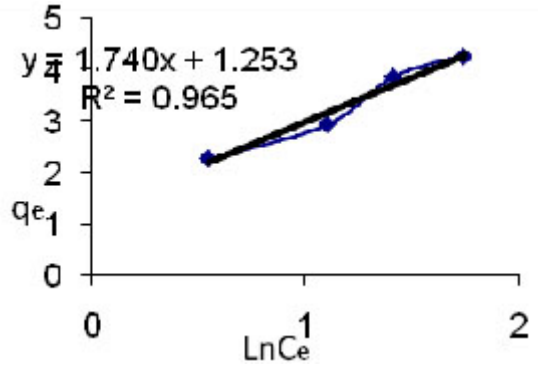

Fig. 4: Adsorption of vitamin B2 graph model based on compliance

Here q is the amount of dissolved adsorbate (mgg^{-1}),C_{eq},q_e is dissolved concentration in the balance moment b and q_m are Langmuir constants.q_m is adsorption balance constant and b is also adsorption capacity and a saturated respectively. We can obtain the following relation by rearranging of equation(3):

$$\frac{1}{q}+\frac{1}{qm}=\frac{1}{q_m bCeq} \qquad ...(4)$$

To calculate Lagmuir relation constants; we draw C_e/q_e curve in term of C_e which here $1/q_m$,$1/q_m b$ are slop and width of origin respectively

Corresponding graph (Fig. 3) and parameters KL and qm, respectively, represent the maximum energy absorption and is absorbed in the Table 3.

Temkin isotherm

This model is considered to interact with the adsorbent material by self absorption which is obtained[7]. With the following equation:

$$q_e = RT/b \ln(AC_e) \qquad ...(5)$$

By Considering

$$\frac{RT}{b}=B$$

A linear form of Temkin isotherm will be as following

$$Q_e=B_1 \ln A+B_1 \ln C_e \qquad ...(6)$$

In this relation, A (L / mg) is equal bond constant relate to mlent maximum bond energy. B (J / mol) is Temkin isotherm constant and proportional adsorption therm. Adsorption data can be derived form equation (6).

CONCLUSION

The present research showed that the concentration of carbon nano-tubes of 0.01 grams to adsorb vitamin B2 has higher efficiency .The parameter that includes vitamin B2 concentration and type absorber has a strong impact on the efficiency of adsorption. 10ppm concentration reaches its maximum and the constants associated with this isotherm and the correlation coefficient R2 in a linear form in three Tables 3 is given. Based on the correlation coefficient, the Freundlich isotherm has the highest value so vitamin B2 obeys the Freundlich isotherms.

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