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Comparative of isothermsadsorption eriochrome black t and methyl red by multi-wall carbon nanotube and carbonmolecular sieveswith models freundlich,Temkin, Langmuir

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ABSTRACT

Eriochrome BlackT and methyl redabsorptionby carbonnanotubesandcarbonmolecular sieveshas special relevance because Eriochrome BlackT as anindicatormagnesiumisusedin various quantities PH andmethyl redisanacid-baseindicatorintitrationsgenerallystrong acids, strong basesand weak, evenindilutedsolventsused. Compoundsare absorbeddepends on thesampleconcentration. Eriochrome BlackTandmethyl redabsorption isothermswithmany modelscan be investigated. The purposeof thisinvestigation is theadsorptionisothermEriochrome BlackTandmethyl redbymulti-walledcarbon nanotubes (MWCNT) andcarbonmolecular sieve(CMS)with the modelsLangmuir,Freundlich,Temkin.By maximum wavelength is obtained by spectrophotometer (uv / vis) model (JENWEY) and different concentrations are obtained from made solution and their adsorptions, and relative diagram was drawn. Findings fromexperimentswiththisthreematchedmodelandof thismodeldifferent parameterswere obtained. The results showed thattheImpact of concentration offraction of thesurfacecoveredby theTemkinmodelforcarbonmolecular sievewith the amount of99.2% by the methyl red and Freundlichmodelforcarbonnanotubesbymethyl redwith the amount of99.6% and Freundlichmodelforcarbonnanotubes by Eriochrome BlackT with the amount of100% andFreundlichmodelforcarbonmolecular sieve by Eriochrome BlackTwith the amount of 100%.

KEYWORDS

Isotherms;
Adsorption;
Eriochrome BlackT;
Methyl red;
Multi-walled carbonnanotubes;
Carbonmolecular sieve.

INTRODUCTION

Multi-walled carbon nanotubescan be manyatoms andmoleculesadsorbedontheir surface, such as metal elementslithium, potassium, rubidium, cesium, and non-metal, such as hydrogen, oxygen, nitrogen and methanoltoabsorb. Absorptioncharacteristics of nanotubesfor absorbinggasessuch ashydrogenandothergases[1]. Since the discovery ofcarbon nanotubesin

1991,generatedhugeactivityinmany areas ofsciencesand engineering,accordingphysical and chemicalproperties ofcarbon nanotubeswas performed. Thesepropertiesnanotubesidealnot only fora broad rangeof applications, but asatest bedfor fundamental science as well[2]. Carbon nanotubes, nanotubes are long,slenderfullereneswhere thewalls of thetubeshexagonalcarbon(graphite structure) andoftenstoppedat each end. Thisformscage-like carbonexceptionallypropertiesthathas come into beingas a result oftheir symmetricstructure[3].

CMS has an amorphous structure, carbon materials by a very narrow distribution of sizes very small to detect specific molecules based on their size and shape. The use of lignocellulosic biomass as a Cheap carbon source and abundant for the production CMS is the sorption process[4]. This carbon molecular sieve can be made coal, oil, biomass, and polymeric precursors were developed and widely used for gas separation and storage applications[5]. Molecular sieves with the microstructure of zeolite arranged as widely as catalysts, adsorbents and ion exchange media used.[6]

Eriochrome Black T as an indicator of the sensitivity of different amounts of magnesium in the PH. Eriochrome black T shaped complexes with cobalt, nickel, copper, iron, and titanium, from which is released dyestuff is on adding EDTA. Direct titration of these metals using Eriochrome Black T as the indicator is not possible and if other metals, calcium or magnesium, be titrated, even small amounts of metal must be coated[7]. Eriochrome Black T is used also detect the presence of rare earth metals[8].

Methyl red shiny crystal violet or dark red powder and is slightly soluble in water, easily soluble in alcohol and glacial acetic acid. Transmission distance methyl red between PH 4-4 (red) and pH 6.2 (yellow) is. Initially with red color starts and yellow color first time looks at high PH.in the pH 4.4 Methyl red is an acid-base indicator that normally titration of strong acids, strong bases and weak, even in the dilute solvents used. To determine the end point of in the titration micro use. The detector is sensitive to than carbon dioxide and most of its color determines PH by measuring the in the buffer solutions and without buffer with regard Gillespie method used. Methyl red for titration of aliphatic amines, heterocyclic nitrogen, and different medicines essential

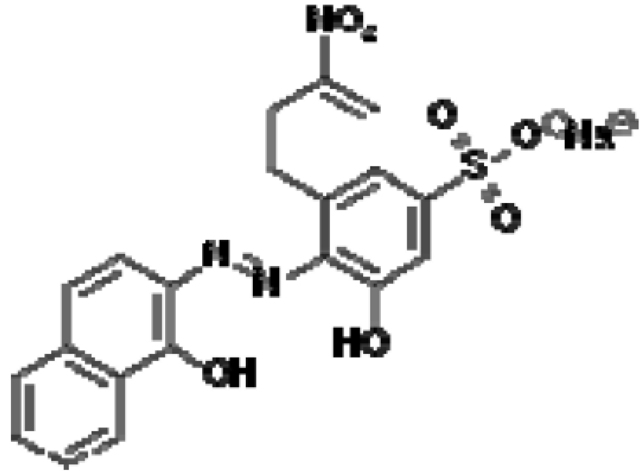

Figure 1: Eriochrome black T

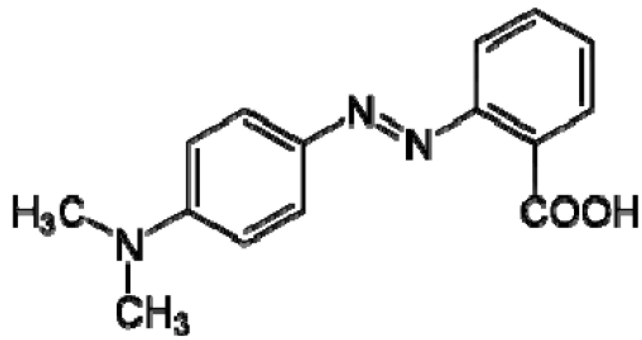

Figure 2 : Methyl red

1, 4Dioxane, hydrocarbon solvent mixture glycol and chloroform are used.[7]

EXPERIMENTAL

We in this first tested the methyl red by alcohol and Eriochrome Black Tby distilled water solution with concentration 100ppm in 250ml Volumetric flask standards have made. Then concentrations of 10, 20, 30, 40, 50 and 60ppm in 50ml Volumetric flask by the equation M1V1 = M2V2 standard've made. Then 10 ml of each of the concentrations the 3 test tube as such that the tube first shed 10 ml of Eriochrome Black Tsolution made of without carbon nanotubes and carbonmolecular sieves, In the amount second test tubes 0.002 g of carbon nanotubes shed into a test tube and then add 10 ml of the above solution smooth it by filter paper and in the amount of third test tube 0.002 g of carbonmolecular sievesshed into test tube and then add 10 ml of the above solution smooth it by filter paper. Absorption related to Eriochrome Black Tconcentrations of 100ppm taken and the max Landa

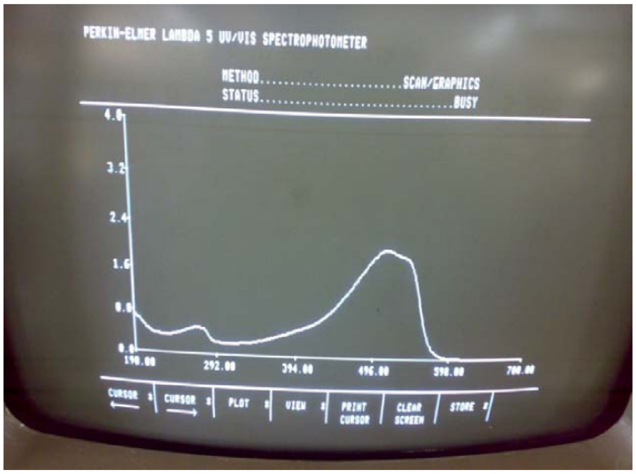

Figure 3 : Image absorption of methyl red without carbon nanotubes and carbon molecular sieve

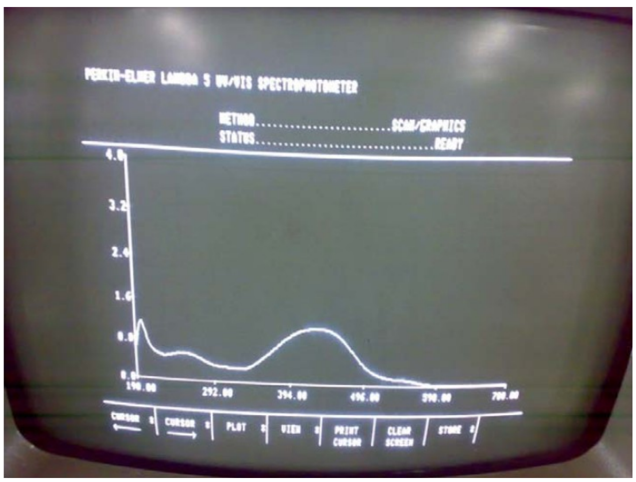

Figure 4 : Image absorption of methyl redonto thecarbon molecular sieve

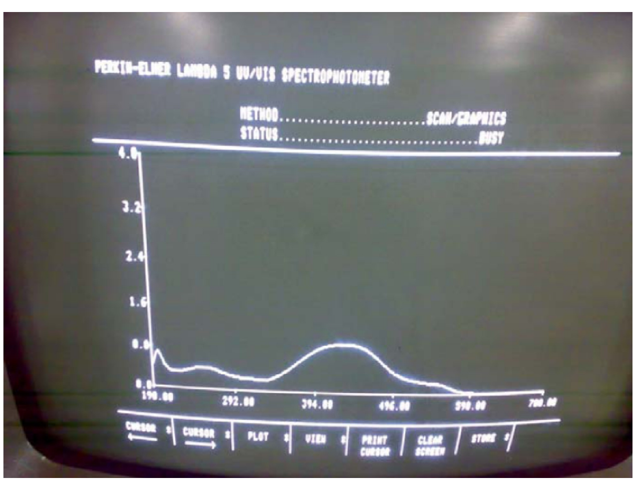

Figure 5 : Image absorption of methyl redonto thecarbon nanotubes

notes, and then according to the max Landa and also reset to zero the device Witness by solution, we have measured the absorption of each concentration for methyl red we act the same way. It should be noted that the Witness solution of for Eriochrome Black Twithout carbon nanotubes and carbonmolecular sievessolution of distilled water and for methyl red alcohol is. When carbon nanotubes or carbon molecular sieve add Witness solution for eriochrome Black T containing distilled water and carbon molecular sieves or carbon nanotube is by the filter paper, have smooth and Witness solution for methyl red contains alcohol and carbon molecular sieves or carbon nanotubes is by the filter paper, have been smooth.

Below 3 Image of concentrations 20 ppm methyl red absorption by carbon molecular sieves and carbon nanotubes have been shown.

MATERIALS AND METHODS

Devices and tools

In this research spectroscopic device for determining the concentration of uv / vis, analytical balance (Mettler H 30) with an accuracy of 0.0001 gram air Volumetric flask 250 and 50 ml, experiment tube and funnel filter paper is used.

Chemical material

Multi-walled carbon nanotubes with high purity 95% and eriochrome black T and methyl red were purchased from Aldrich. Merck has been used to prepare the company. Carbon molecular sieve were purchased from company HATCO Tehran.

RESULTS

The equilibrium adsorption isotherms

Equilibrium relationships between adsorbent and adsorption are defined by isotherms adsorption that show the relationship between the amount of adsorbed material and some of it remains in the balance.

Langmuir model

This adsorption model is used to adsorption a single layer. All these models assume the same energy adsorption sites on the surface of the adsorbent, the linear form is expressed by the equation[9].

$$\frac{C_e}{q_e} = \frac{1}{q_m b} + \frac{1}{q_m} C_e$$

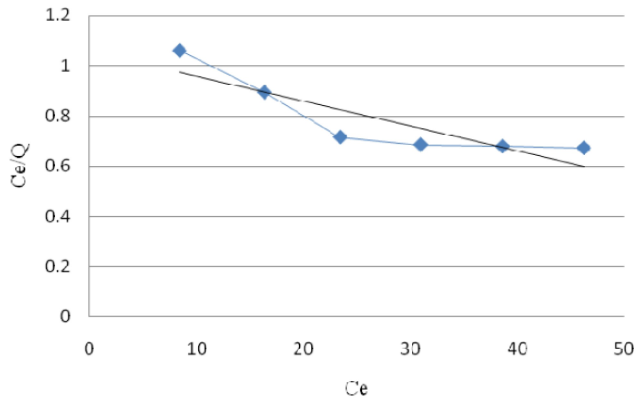

Figure 6 : Diagram of methyl red adsorption by carbon nanotubes based on Langmuir adsorption model

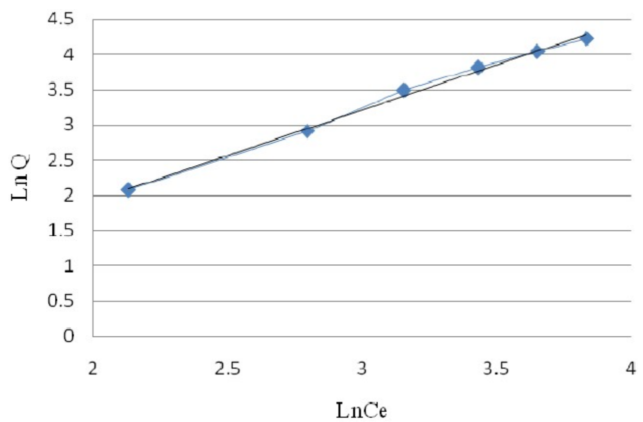

Figure 7 : Diagram of methyl red adsorption by carbon nanotubes based on Freundlichadsorption model

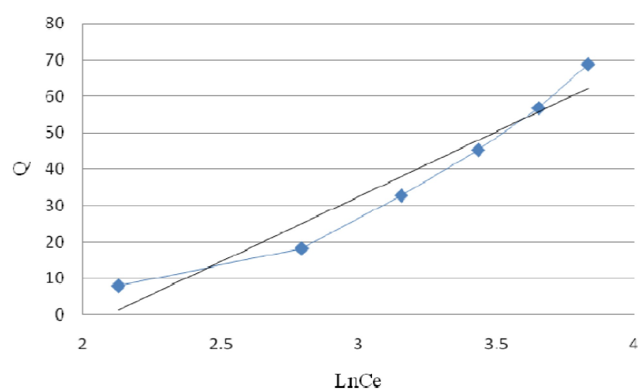

Figure 8 : Diagram of methyl red adsorption by carbon nanotubes based on Temkin adsorption model

Where qe is the amount of adsorbed from solution (mgg-1) and Ce concentration in solution at equilibrium (mgL-1) and Langmuir constants qm and b are constants that represent the equilibrium adsorption capacity and adsorption layer is saturated.

Freundlich model

Freundlich isotherm is an empirical equation to further understanding of metal ion adsorption on heterogeneous surface by multilayer adsorption and adsorp-

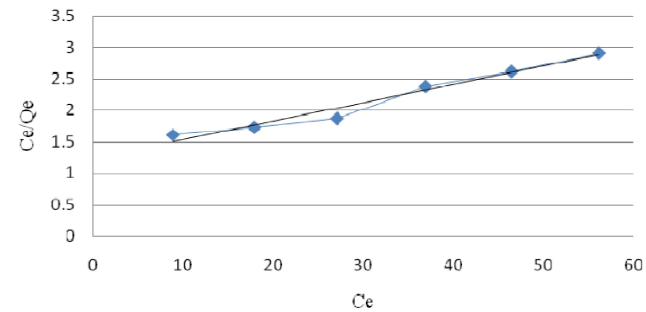

Figure 9 : Diagram of methyl red adsorption by carbon molecular sieve based on Langmuir adsorption model

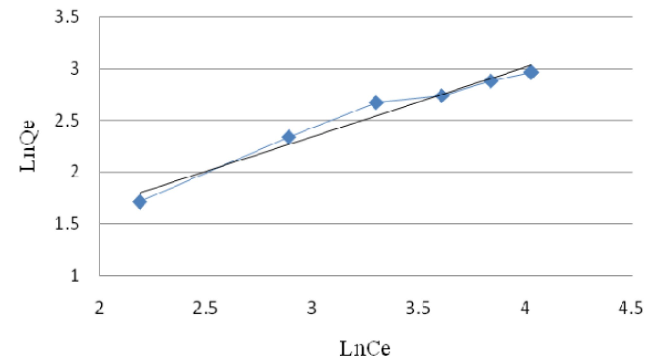

Figure 10 : Diagram of methyl red adsorption by carbon molecular sieve based on Freundlichadsorption model

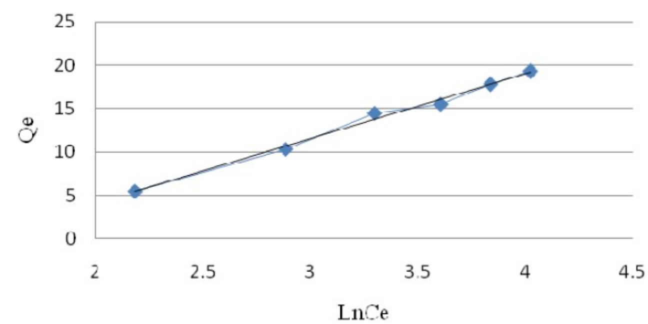

Figure 11: Diagram of methyl red adsorption by carbon molecular sieve based on Temkin adsorption model

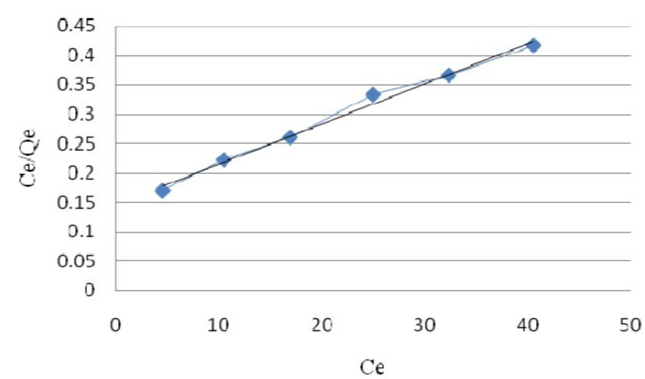

Figure 12 : Diagram of eriochrome black T adsorption by Carbon Nanotube based on Langmuir adsorption model

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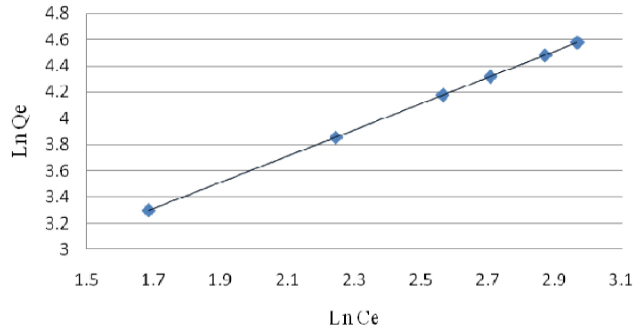

Figure 13 : Diagram of eriochrome black T adsorption by Carbon Nanotube based on Freundlich adsorption model

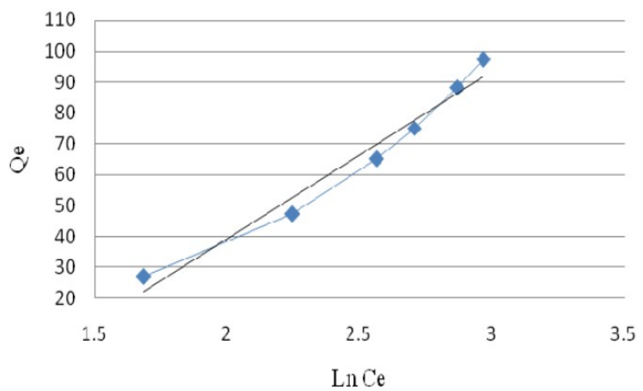

Figure 14 : Diagram of eriochrome black T adsorption by Carbon Nanotube based on Temkin adsorption model

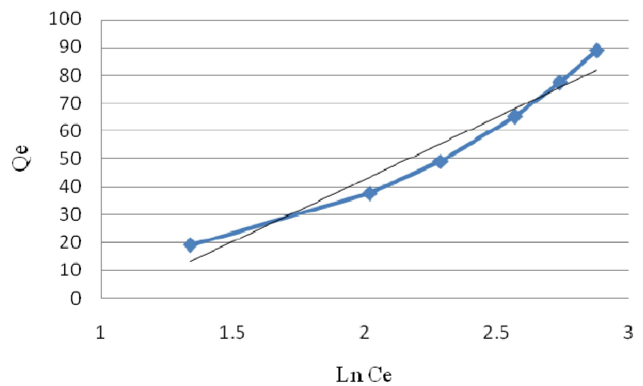

Figure 15 : Diagram of eriochrome black T adsorption by carbon molecular sieve based on Temkin adsorption model

tion of the solved amount of the infinite increase the concentration of most[10] Freundlich adsorption isotherms are described by the following equation:

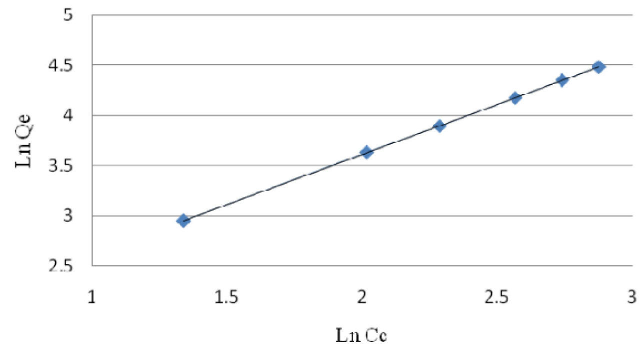

Figure 16 : Diagram of eriochrome black T adsorption by carbon molecular sieve based on Freundlich adsorption model

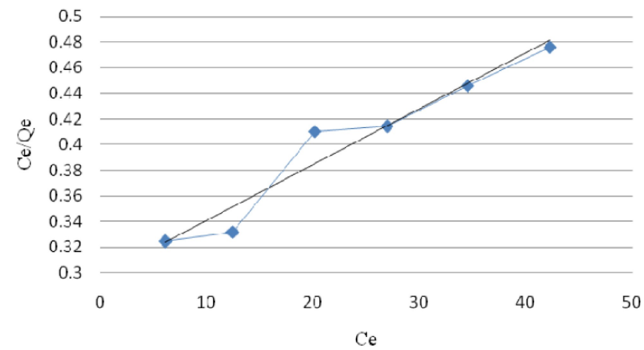

Figure 17 : Diagram of eriochrome black T adsorption by carbon molecular sieve based on Langmuir adsorption model

$$\mathbf{Lnq_e = Lnk_f + \frac{1}{n}LnC_e}$$

In this equation, qe is the adsorption solved (mgg-1) and Ce concentration in solution at equilibrium (mgL-1) and the constants n and kf is respectively indicating the adsorption intensity and adsorption capacity.

Temkin model

Temkin isotherms contain a factor that interaction between the adsorbent and particles adsorb to clearly indicate[11-12]. Temkin in to these isotherms are linear forms:

$$\mathbf{q_e = BLnA + BLnc_e}$$

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

TABLE 1: Parameters and correlation coefficients of isotherm models

Temkin model			Freundlich model			Langmuir model			
A(L/mg)	R^2	B	R^2	n	K(mg/g)	b(L/mg)	R^2	Q(mg/g)	
0.2342	0.992	7.447	0.967	1.49	1.391	0.023	0.968	34.483	Carbon molecular sieve by methyl red
0.12	0.937	-74.76	0.996	0.776	0.25	-0.0085	0.77	-111.11	Carbon nanotubes by methyl red
0.35	0.95	44.66	1	1	5	0.0135	0.943	250	Carbon molecular sieve by eriochrome black T
0.28	0.966	54.1	1	1	5	0.041	0.991	166.7	Carbon nanotubes by eriochrome black T

In this relationship a terms of (L / mg) is equal to a constant link associated with the maximum binding energy, b in terms of the (J / mol) isotherms temkin constant and B (without unit) is proportional to the heat of adsorption.

Process adsorption isotherm of eriochrome black T and methyl red on the carbon nanotubes and carbon molecular sieve are shown in Figures 6 to 17 and calculated the parameters of these models are shown in TABLE 1.

CONCLUSIONS

Considering that the adsorption onto a solid surface due to attractive forces between molecules of functional groups The existing at solid surface and is absorbed by the material, We reached to the conclusion that methyl red adsorption onto carbon nanotubes for better absorption of eriochrome black T because methyl red is a small structural and prohibition would create less space (less benzene ring) and methyl red with better functional groups are linked together to form several layer on the active sites, has been absorbed. Carbon nanotubes are multi-layer structure and due to having the pores and also the small methyl red amount of in each layer of adsorbed methyl red but eriochrome Black T because of the large structure and prohibition space failed to establish a strong bond and the lower on the layer of carbon nanotubes has been absorbed.

Methyl red adsorption onto carbon molecular sieve better is adsorption eriochrome Black T . Due to carbon molecular sieve having pores on the surface much is better able methyl red which a functional group less than eriochrome Black T is and prevents space become less will attract and methyl red functional groups are linked together better and are absorbed on the active sites but eriochrome Black T because of the large prevents space and structure the lower layers of over carbon molecular sieve has been absorbed.

Methyl red adsorption onto CNT and carbon molecular sieve (CMS) into attractive functional groups COOH and pair of electrons non-link oxygen which increases the resonant and density of negative and property of their acidic increases that this intensity absorption increases but eriochrome Black T due to a very strong electropositive groups (OH), acidic property of decreases and lowers the absorption intensity. Methyl red has a lower than aromatics eriochrome Black T is. According to the results examined in the case CNT and CMS in this work, the model Temkin for Methyl red adsorption by carbon molecular sieve and carbon nanotubes have a more consistent and represents the model of interaction between the adsorbent and particles adsorb is and Freundlich model to absorb eriochrome Black T by carbon molecular sieve and carbon nanotubes more consistent and this model represents ion adsorption over heterogeneous surfaces with multilayer adsorption and amount of adsorption increased with increasing concentration are.

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