Comparative of isotherms adsorption eriochrome black T and methyl red by multi-wall carbon nanotube and carbon molecular sieves with models freundlich, Temkin, Langmuir

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ABSTRACT

Eriochrome Black T and methyl red adsorption by carbon nanotubes and carbon molecular sieves has special relevance because Eriochrome Black T as an indicator magnesium used in various quantities PH and methyl red as an indicator titration generally strong acids, strong bases and weak, even in diluted solvents used. Compounds are absorbed depending on the sample concentration. Eriochrome Black T and methyl red adsorption isotherms with many models can be investigated. The purpose of this investigation is the adsorption isotherm Eriochrome Black T and methyl red by multi-walled carbon nanotubes (MWCNT) and carbon molecular sieves (CMS) with the models Langmuir, Freundlich, Temkin. By maximum wavelength is obtained by spectrophotometer (uv/vis) model (JENWAY) and different concentrations are obtained from sample solutions and their adsorptions, and relative diagram was drawn. Findings from experiments with three matched models and different parameters were obtained. The results showed that the impact of concentration of fraction of the surface covered by the Temkin model for carbon molecular sieve with the amount of 99.2% by the methyl red and the Freundlich model for carbon nanotubes by methyl red with the amount of 99.6% and the Freundlich model for carbon nanotubes by Eriochrome Black T with the amount of 100% and the Freundlich model for carbon molecular sieve by Eriochrome Black T with the amount of 100%.

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INTRODUCTION

Multi-walled carbon nanotubes can be many atoms and molecules adsorbed on their surface, such as metal elements, lithium, potassium, rubidium, cesium, and non-metal, such as hydrogen, oxygen, nitrogen and methanol to absorb. Adsorption characteristics of nanotubes for absorbing gases such as hydrogen and other gases [1]. Since the discovery of carbon nanotubesin
1991, generated huge activity in many areas of science and engineering, according to physical and chemical properties of carbon nanotubes was performed. These properties nanotubes ideal not only for broad range of applications, but as test bed for fundamental science as well[2]. Carbon nanotubes, nanotubes are long, slender fullerenes where the walls of the tube hexagonal carbon (graphite structure) and often stopped at each end. This forms cage-like carbon exceptionally properties that has come into being as a result of their symmetric structure[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

EXPERIMENTAL

We in this first tested the methyl red by alcohol and Eriochrome Black T by 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 \( M_1 V_1 = M_2 V_2 \) 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 T solution 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 sieveshed into test tube and then add 10 ml of the above solution smooth it by filter paper. Absorption related to Eriochrome Black T concentrations of 100ppm taken and the max Landa
Comparative of isotherms adsorption eriochrome black T and methyl red 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 T without carbon nanotubes and carbon molecular sieves solution 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\(^9\).

\[
\frac{C_e}{q_e} = \frac{1}{q_m b} + \frac{1}{q_m} C_e
\]
Where $q_e$ is the amount of adsorbed from solution (mg g$^{-1}$) and $C_e$ concentration in solution at equilibrium (mg L$^{-1}$) and Langmuir constants $q_m$ 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-
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Freundlich adsorption iso-therms are described by the following equation:

\[ \ln C_e = \ln k_f + \frac{1}{n} \ln q_e \]

In this equation, \( q_e \) is the adsorption solved (mg g\(^{-1}\)) and \( C_e \) concentration in solution at equilibrium (mg L\(^{-1}\)) and the constants \( n \) and \( k_f \) 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 interaction of the solved amount of the infinite increase the concentration of most\(^{[10]}\). Freundlich adsorption isotherms are described by the following equation:

\[ q_e = BLnA + BLnc_e \]

\[ B = \frac{RT}{b} \]

In this equation, \( q_e \) is the adsorption solved (mg g\(^{-1}\)) and \( C_e \) concentration in solution at equilibrium (mg L\(^{-1}\)) and the constants \( n \) and \( k_f \) is respectively indicating the adsorption intensity and adsorption capacity.

<table>
<thead>
<tr>
<th>TABLE 1: Parameters and correlation coefficients of isotherm models</th>
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<tbody>
<tr>
<td>Temkin model</td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>A (L/mg)</td>
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<tr>
<td>0.2342</td>
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<tr>
<td>0.12</td>
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<tr>
<td>0.35</td>
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<td>0.28</td>
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In this relationship a term of \((L/\text{mg})\) is equal to a constant link associated with the maximum binding energy, \(b\) in terms of the \((J/\text{mol})\) 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.

**REFERENCE**

[9] F.Martinez, A.Hernandez; Protein adsorption onto
Full Paper


