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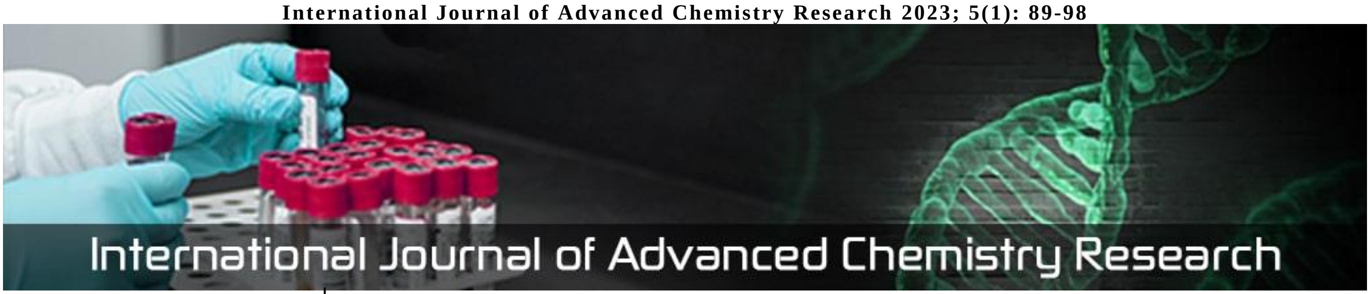

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Study of the factors affecting the adsorption efficiency of some chemical pesticides activated carbon at the nanoscale

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Abstract
The research included the use of nano-activated carbon commercial carbon and the diagnosis of nano activated carbon using different, techniques such as infrared spectroscopy (FT-IR), X-ray diffraction (XRD), scanning electron microscope (SEM), dispersion energy x-rays sine (EDX) Besides surface area analysis (BET), as it showed the results of a spectrum (FT-IR)the activated carbon does not contain, any active group, that is, it is chemically inert, and this is a good characteristic of nano activated carbon, as shown by the results of (XRD) the average crystal size of, the prepared activated carbon was found to be equal to (16.973) nm, which confirms that the prepared carbon contains nanoparticles, as shown by the results (SEM) and the (EDX) the sizes of the prepared carbon particles are approximately between (25.98-111.83 nm) and that the shape of the stomata (pores) on the surface bear the characteristics of nano materials with their properties, and that the highest percentage of carbon was (87.46%), and this result supports the efficiency of nano activated carbon and its use in the adsorption process, in addition to that, activated carbon has a surface area obtained according to the theory (BET) How much (712.81) m^2/g, It is very suitable for use as an adsorbent, and the adsorption of some chemical pesticides from their aqueous solutions was studied using commercial activated carbon. the study included the effect of each of the amount of adsorbent, the effect of contact time, the effect of the initial concentration, the effect of the pH function and the effect of temperature on the adsorption system, the study showed that the adsorption efficiency follows the following order for the pesticides under study (GOL > TFR) on the surface of, activated carbon, and that the adsorption system reaches equilibrium at a time of (50-60) min, and the highest percentage of adsorption on the surface of, activated carbon, is at the (pH=4) and the best amount was (0.1) gm of adsorbed substance to the system, and from studying the effect of temperature, it is clear that the percentage of pesticide adsorption on the surface of activated carbon decreases with increasing temperature, as well as studying the effect of the initial concentration. the adsorption efficiency decreases with increasing concentration, but the adsorption capacity (qe) increases with Increase focus when the temperature is constant.

Keywords: Activated carbon, nano, adsorption, chemical pesticides

1. Introduction

That pain pollution Chemical pesticides are a serious problem in the environment, as the use of pesticides has increased in recent decades, resulting in the flow of chemical pesticides into natural water sources, which negatively affects the life of living organisms [1], and the impact of environmental pollution is not limited to humans only, but also to include animals and plants, as it leads, directly or indirectly, to happening Harm to humans, living organisms, or the environment in which living organisms exist [2], and count pesticides It is one of the most dangerous chemical compounds that cause water pollution due to its wide use, which maintains its presence in aquatic environments for a long time, which helps its transmission and accumulation in the bodies of aquatic organisms to the extent that it poses a serious threat to human life [3, 4], and you know Pesticides are among the important chemical pollutants that have a direct impact on the environment, as they increase the production of agricultural crop, but at the same time have a side effect on human health, and the effect of pesticides on Human health is represented by genetic mutation and cancer, and it has a significant effect on inhibiting the activities of enzymes [5, 6], Despite its benefits, only they can be dangerous compounds It has collateral damage to the ecosystem, the misuse of pesticides in terms of the recommended dose or the appropriateness of the pesticide.

For the purpose of control, or mishandling of pesticides leads to many risks, if any there are more than (220,000) deaths in the world annually due to improper handling of pesticides [7], and for this reason there was a need for existence and development there are many ways to treat water pollutants whether membership of it or inorganic It is within this technique adsorption, is the adsorption of the most prominent and important Effective and safe techniques used in the removal and treatment of these pollutants, which are difficult to remove by other methods [8], In addition, that adsorption is a simple technology with low economic costs compared to other treatment methods. For this reason, many researchers in this field resorted to developing different adsorbents. and from between adsorbents common and used is the (activated carbon), and has the great development in the applications of the adsorption process prompted the need to provide new adsorbent materials to be used in the treatment of environmental pollution. On these materials should be efficient and have a low economic cost retrieve it then Reuse it again.

2. Practical part

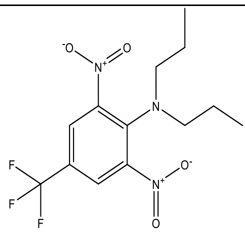
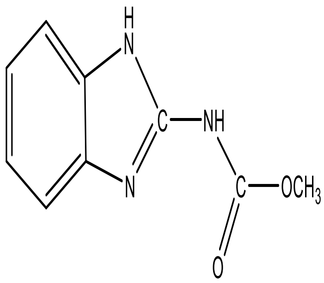
2.1 The Chemicals

The following chemicals were used, which were prepared by the companies indicated opposite each one of them, without purification, because they have a high degree of purity, as shown in the table (1) (2):

Table 1: Used chemicals and the companies supplying them.

company	purity%	Chemical formula	Subject Name	N
Fluka	37.0%	HCl	hydrochloric acid	1
BDH	96.0%	NaOH	Sodium hydroxide	2
Merck	100%	-----	Powder activated carbon	3

Table 2: the pesticide used and some of the properties and companies them.

Λ max (nm)	pH*	M.wt g/mol	the color	Structural formula	processing company	pesticide symbol
446nm	6.41	335.28	yellow	 Trifluralin	Agar	TRF
280nm	5 6.23	191.19	white	 Goldazim	Arysta-Belgium	GOL

2.2 Instruments used

Table 3: Instruments used in the study.

No	the device name	Model and origin
1	UV -Visible Spectrophotometer	SHIMAMDZU(UV-1900 PC)
2	Shaker with water bath	Julabo, SW23
3	pH- Meter	Jenway (3510 pH- meter)
4	Laboratory Oven	M420-elektro.mag
5	Furnace Electrical	Carbolite- England its max
6	X-ray diffraction	Philips-PW1730
7	Infrared Spectra (FT-IR)	1800FT-IR Shimadzu
8	Scanning Electron Microscope (SEM)	TESCCAN-MIRAIII
9	Energy Dispersive X-Ray Detection(EDX)	TESCCAN-MIRAIII
10	The Surface Area Analysis (BET)	BELSORP MINI II

2.3 Activation Chemical

1. Taking weight (10) gm of powder activated carbon Carefully.
2. Perform the activation process by adding (10) ml of (NaOH) solution with concentration (0.1) M to powder Non-activated carbon It mixes the content in the beaker completely and puts the homogeneous mixture insideNickel plated stainless steel bowlfor two hours at a temperature (800 ºC).
3. Cool the carbon the resulting tonic and washed, with deionized water several times, to get rid of remains Impurities and (pH) equation.
4. Activated charcoal equation (10) ml of hydrochloric acid concentration of (0.1) M to remove the remaining ions Al-basic. Repeat process the wash with water Free of ions several times to purify it of residue Effectsour.
5. Use The device (pH-Meter) to ensure the neutrality of the acidity of the carbon.
6. Dry activated charcoalrecordfor a duration4degree hours (120 ºC).
7. Grinding the activated charcoal resulting from the previous step by means of a mechanical mill to obtain fine particles, then it was sifted by molecular sieves

with a size of (35 micron) It was kept inside a sealed package and in a desiccator, isolated from air and moisture [9].

3. Results and Discussion

3.1 Topography Characterization

For the purpose of topographic diagnosis (Topography) of the surface of activated charcoal using infrared spectroscopy (FT-IR), X-ray diffraction (XRD) and scanning electron microscopy (SEM) as well as surface area analysis (BET) as follows:

3.2 FT-IR spectroscopy

Infrared spectrum (FT-IR) for activated charcoal-commercial, in order to see if activated charcoal contains, effective aggregates (Effective groups) or not, and Figure (1) represents the infrared spectra of commercial activated charcoal, Evidenced by the shape of the infrared spectrum (FT-IR) of commercial activated carbon indicates that activated carbon does not contain any active group effective groups may affect the adsorption process of the materials under study, and thus we conclude that activated carbon is (chemically inert)and this is a good characteristic.

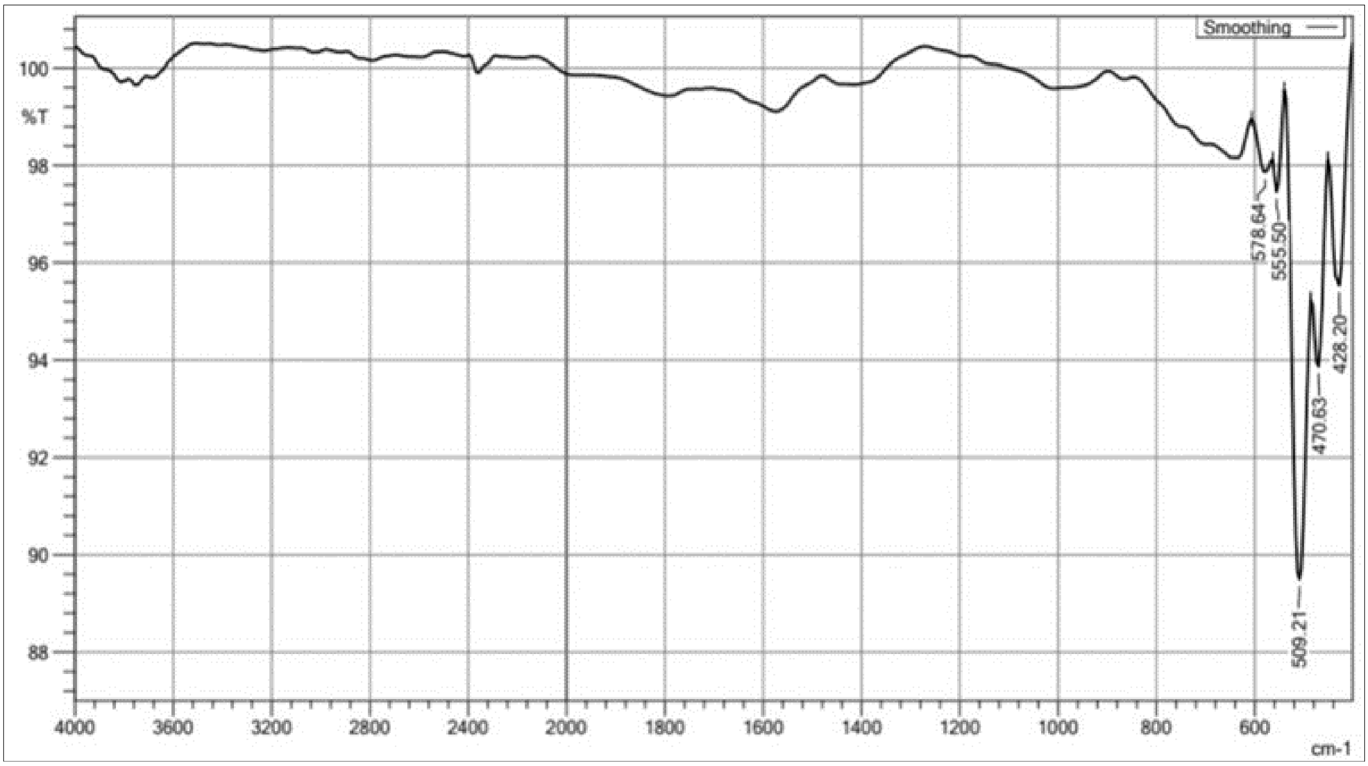


Fig 1: (FT-IR) for nan- activated carbon.

3.3 X-ray diffraction (XRD)

The surface of the adsorbent material under study was identified using an X-ray diffraction machine(XRD) to find out the crystal form of the prepared nanoparticles through Miller coefficients, as the purity of the prepared coal is identified.activeAs well as calculating the size of nanoparticles using the Debye-Scherrer equation (Debye Scherer Equation) (10(:

$$D = \frac{K\,\lambda}{\beta\ coscos\ \theta} \quad (1)$$

As if:

D = particle size in nanometers.

K = Debye constant and equal to (0.94).

λ = the wavelength of the x-ray and is within limits (1.5406) angstrom for the element copper, and it is converted into a unit of nm, as each (1 angstrom = 10^{-1} nm), so the wavelength is equal to (0.15406) nm.

β= total width at the largest half of the apex (Full Width at Half Maximum) (FWHM), measured in degrees (Deg) and converted to radian units, as the (FWHM) value is multiplied by the amount$\frac{\pi}{180}$.

$a\theta$= cosine of the diffraction angle in units (Degree).

Figure (2): X -ray diffraction spectrum (XRD) for nano-activated charcoal.

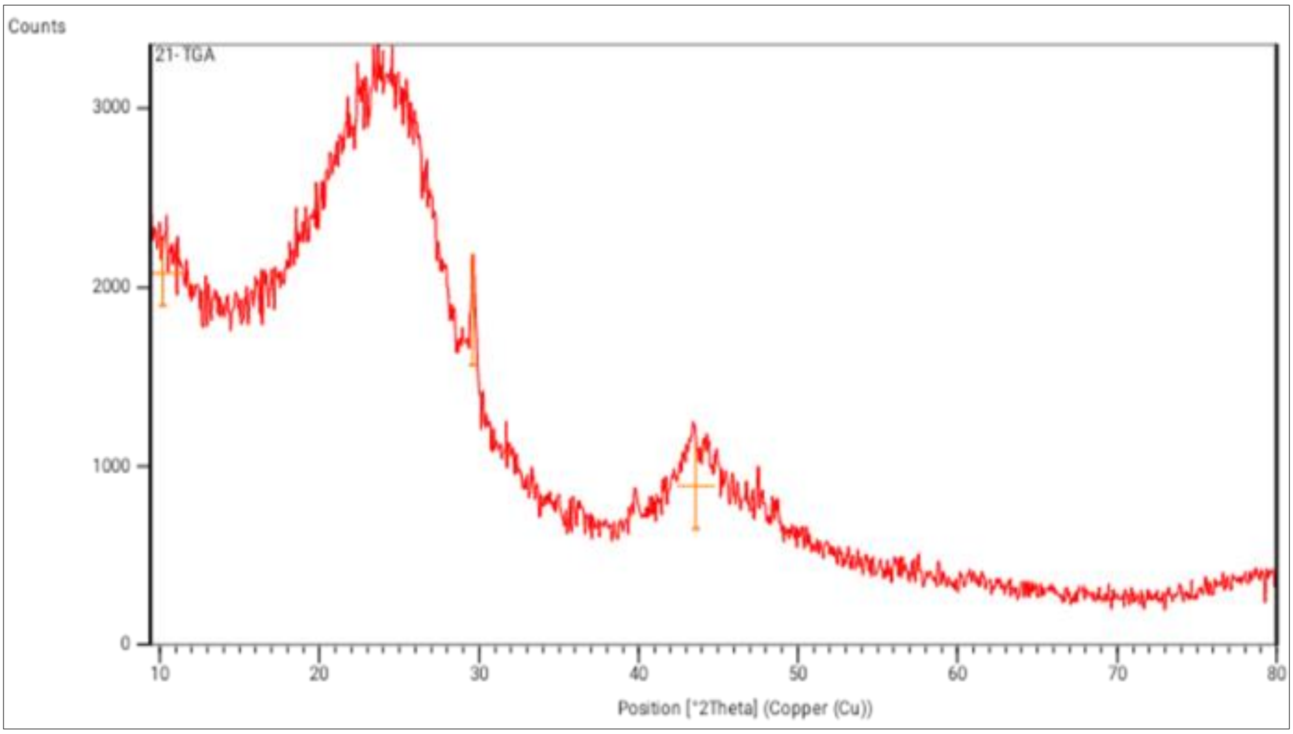


Fig 2: X-ray diffraction spectra (XRD) for activated charcoal.

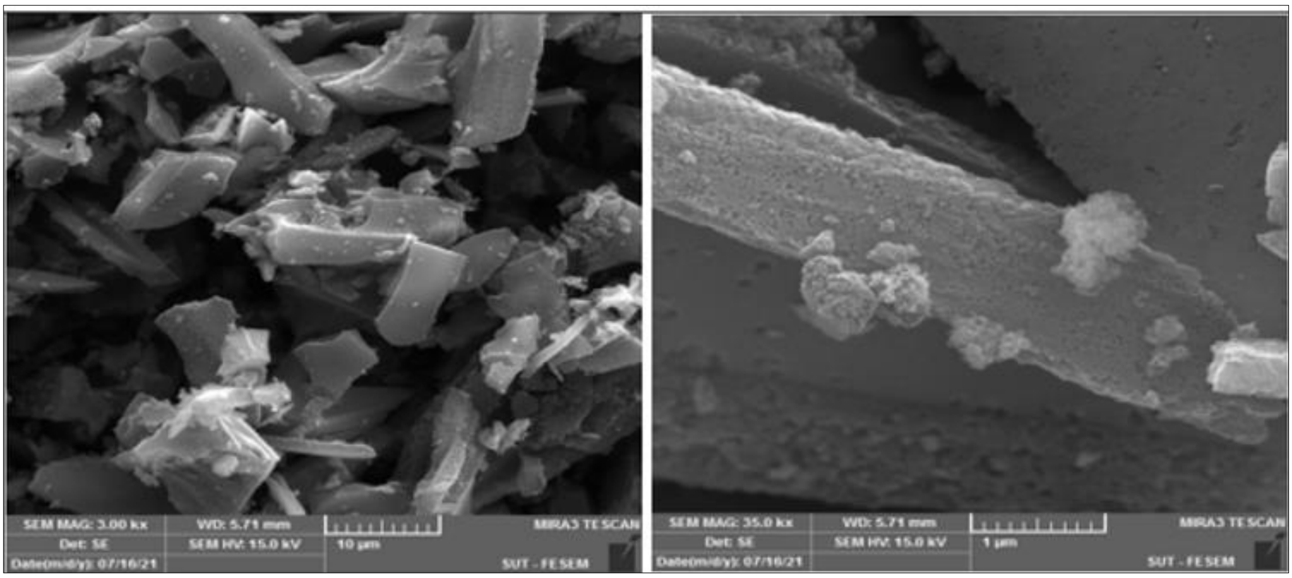
and table (4) shows the data values obtained from the X-ray diffraction spectra of the three strongest beams, which were used to calculate the average crystal size of the activated charcoal sample record commercial which was found to be equal (16.973) nm, which confirms that the prepared charcoal contains nanoparticles.

Table 4: X-ray diffraction values (XRD) and the values of the sizes of the formed nanoparticles for.

No. of peak	Pos. [°2Th.]	FWHM Left [°2Th.]	Rel. Int. [%]	Cry. Size [nm]	Over. Size [nm]
1	10.1799	2.3616	58.15	3.5273	16.97366
2	29.6093	0.1968	100.00	43,6091	
3	43.6326	2.3616	76.99	3.7844	

3.4 Scanning electron microscope (SEM)

Examination results are shown using a scanning electron microscope. (SEM) Noticeable variation in the size of adsorbent particles, as well as variation in pore size and craters appearing on the surface of the adsorbent, which is a feature of the prepared nanocarbon. The size of these pores and craters and their density on the surface plays a major role in providing surface area. Possible contact with the substance to be adsorbed, as the scanning electron microscope measurements showed the shape and size of the prepared nanoparticles of charcoal with different nano and micro magnifications (10, 1, 500, 200) that they are in the form of sticky nanoparticles or semi-square in shape and with different nano and micro sizes, as illustrated by the figures (3). The sizes of the prepared charcoal particles appeared approximately between (25.98-111.83nm), as shown in the following figure.



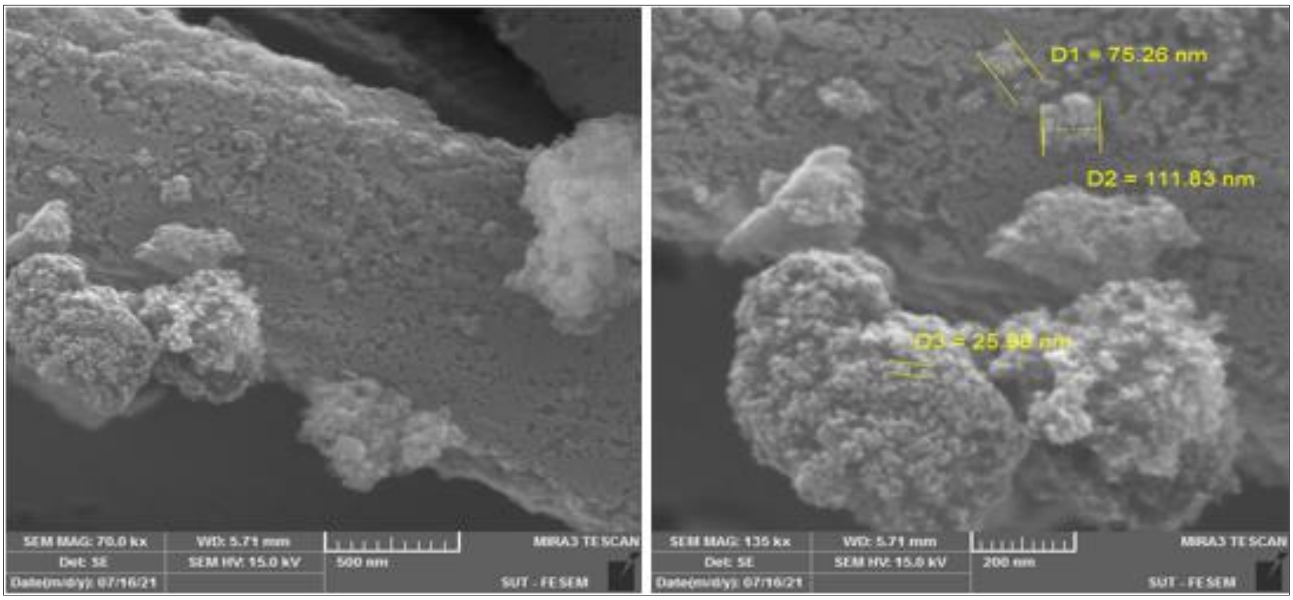


Fig 3: Scanning Electron Microscope (SEM) for activated carbon

It is an analytical technique used, to (Element analysis) to know the Chemical Composition, of the materials under study, studying the interference between, the source of excitation of (X-ray) and the sample, based on the basic principle, that each element has, a distinctive or unique atomic composition that gives (X-ray), which describes, the atomic composition of the elements to be uniquely identified from, each other [11]. These were used Figure (4) and Table (5) show that the highest percentage of activated charcoal is carbon (87.46%), followed by oxygen (10.99%), and this result confirms the efficiency of charcoal. The activator, especially because it contains a high percentage of carbon.

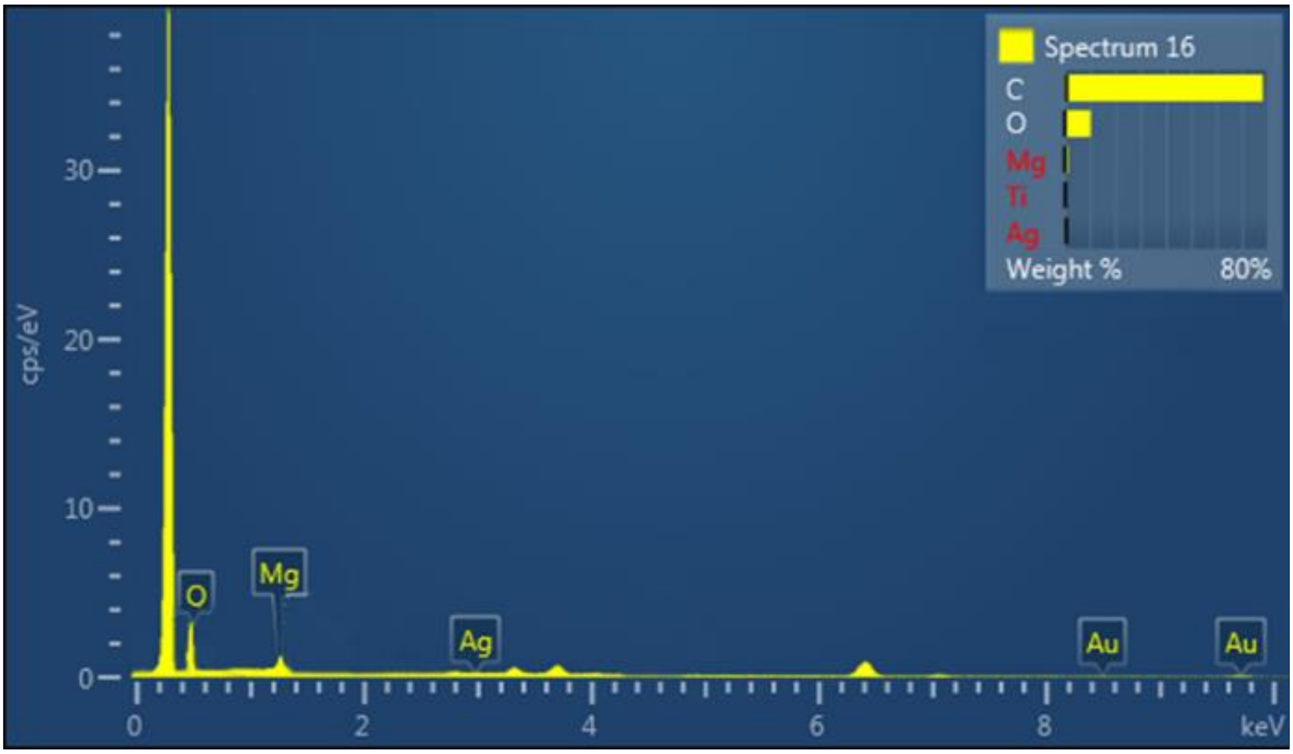


Fig 4: X-ray energy dispersive spectrum (EDX) for activated carbon.

Table 5: Weight and atomic ratios of the constituent elements of the activated charcoal sample.

Element	Weight %	Atomic %
C	87.46	90.29
O	10.99	8.56
Mg	1.06	0.89
Ti	0.42	0.25
Ag	0.07	0.01
Totals	100	100

3.5 Determination of Surface Area (BET)

The measurements were made and the required functions or factors were extracted using several methods, namely [12]: (BET method, Langmuir method, t-method, BHJ method)

The aim of this study is to know the surface area of the charcoal prepared by activating it with plant materials, and after selecting the experimental activation of the system, Activated charcoal was obtained with a surface area according to (BET) theory of (712.81 m^2/g) and as shown in the table (6), which is very suitable for use as an adsorbent, as well as calculating the surface area of the prepared charcoal according to the theory (Langmuir), and it was found to be equal to (696.16 m2/g), and as we notice in Table (6) below.

Table 6: The results of the analysis (BET) for activated charcoal.

BET plot		
V_m	152.28	[cm^3(STP) g^{-1}]
as, BET	712.81	[m^2 g^{-1}]
C	3801.3	
Total pore volume (p/p^0= 0.990)	0.4336	[cm^3 g^{-1}]
Mean pore diameter	2,422	[nm]
Langmuir plot		
V_m	146.97	[cm^3(STP) g^{-1}]
as, Lang	696.16	[m^2 g^{-1}]
B	80,951	
T plot		
Plot data	Adsorption branch	
a_1	831.99	[m^2 g^{-1}]
v_1	0	[cm^3 g^{-1}]
BJH plot		
Plot data	Adsorption branch	
V_p	0.1353	[cm^3 g^{-1}]
rp, peak (Area)	1.21	[nm]
a_p	168.06	[m^2 g^{-1}]

3.6 Study of Adsorption Affecting Factors

3.6.1 Effect of adsorbent dose

The effect of the amount of adsorbent, on pesticide adsorption, was studied chemical and at an initial concentration (10) ppm with the change in the amount of adsorbent, using five different weights, which are (0.5, 0.4, 0.3, 0.2, 0.1) g/L. These experiments were carried out at a temperature of (298) Kelvin and at the natural function ($pH_{Natural}$)

Table 7: Effect of the amount of activated carbon The adsorption capacity and the percentage of adsorption % at a temperature of (298) Kelvin, a shaking time (60) min.

n	**W_t (gm)**	**C_i (mg/l)**	**C_e (mg/l)**	**C_{ads} (mg/l)**	**q_e (mg/g)**	**% ads**
	0.1	10	3,251	6,749	6,749	67.49
TRF	0.2	10	2,887	7,113	3.5565	71.13
	0.3	10	1,701	8,299	2,766	82.99
	0.4	10	1,391	8,609	2,152	86.09
	0.5	10	0.997	9,003	1,801	90.03
	0.1	10	2,811	7,189	7,189	71.89
	0.2	10	2,001	7,999	3,999	79.99
GOL	0.3	10	1,809	8,191	2,730	81.91
	0.4	10	1,319	8,681	2,170	86.81
	0.5	10	0.862	9,138	1,827	91.38

This result can be explained by the increase of the amount of the adsorbent material, the number of eligible sites for adsorption increases, and this increase increases the adsorption efficiency for the ease of adsorption between the particles of the adsorbent and the active sites on the surface of activated carbon, but this causes a decrease in the adsorption capacity, as this An increase in the amount of adsorbent will leave empty active adsorption sites when a fixed concentration of material is used [13] It was found that the weight of (0.1) gm of prepared activated carbon per (100)ml of the solution suffices to conduct subsequent studies, and that; Because it is an appropriate amount that achieves an acceptable rate of removal of the pesticides and elements under study while maintaining the color and achieving a state of equilibrium for the adsorption system. This amount of activated carbon has been adopted in subsequent studies.

3.6.2 Effect of contact time

The effect of contact time is one of the important tests in the study, of the adsorption process, through which the nature of the studied system is determined in any adsorption process, as well as determining the extent of the affinity of the materials to be removed from the contaminated solutions to the adsorbent surface, which is used in the completion of kinetic studies of the adsorption process In addition, the change of adsorption velocity with time and until reaching the equilibrium state is considered essential for the study of adsorption kinetics.

The effect of time was calculated at a fixed concentration (10ppm) and at the normal ($pH_{Natural}$) and by using a fixed amount of activated carbon (0.1) g/l and a shaking speed of (90) revolutions / minute and during periods of time (10-80)min. The obtained results are included in Table (8).

Table 8: Effect of contact time on adsorption, capacity and percentage of adsorption (%) of activated carbon at different temperatures for the pesticides under study (GOL, TRF).

n	T (ºk)	Time (min)	C_t (mg/l)	q_t (mg/l)	% ads	*n*	T (ºk)	Time (min)	C_t (mg/l)	q_t (mg/l)	% ads
TRF	298	10	6.3	6.3	63	GOL	298	10	6,586	6,586	65.86
		20	6,434	6,434	64.34			20	6.8	6.8	68
		30	6,683	6,683	66.83			30	6,884	6,884	68.84
		40	6,749	6,749	67.49			40	6,909	6,909	69.09
		50	6,796	6,796	67.96			50	7,089	7,089	70.89
		60	6,796	6,796	67.96			60	7,089	7,089	70.89
		70	6,721	6,721	67.21			70	7,035	7,035	70.35
		80	6,536	6,536	65.36			80	6,807	6,807	68.07
	308	10	5,677	5,677	56.77		308	10	6,045	6,045	60.45
		20	5,898	5,898	58.98			20	6,387	6,387	63.87
		30	6,383	6,383	63.83			30	6.52	6.52	65.2
		40	6,536	6,536	65.36			40	6,925	6,925	69.25
		50	6,612	6,612	66.12			50	7,015	7,015	70.15
		60	6,612	6,612	66.12			60	7,015	7,015	70.15
		70	6,558	6,558	65.58			70	6,903	6,903	69.03
		80	6,386	6,386	63.86			80	6.78	6.78	67.8
	318	10	5,649	5,649	56.49		318	10	5,917	5,917	59.17
		20	5,887	5,887	58.87			20	6,175	6,175	61.75
		30	6,363	6,363	63.63			30	6,451	6,451	64.51
		40	6,481	6,481	64.81			40	6,793	6,793	67.93
		50	6,596	6,596	65.96			50	6,848	6,848	68.48
		60	6,596	6,596	65.96			60	6,848	6,848	68.48
		70	6,454	6,454	64.54			70	6,759	6,759	67.59
		80	6,351	6,351	63.51			80	6,507	6,507	65.07
	328	10	5,182	5,182	51.82		328	10	5,568	5,568	55.68
		20	5,666	5,666	56.66			20	5,878	5,878	58.78
		30	5,969	5,969	59.69			30	6,252	6,252	62.52
		40	6,318	6,318	63.18			40	6,512	6,512	65.12
		50	6,471	6,471	64.71			50	6,686	6,686	66.86
		60	6,471	6,471	64.71			60	6,686	6,686	66.86
		70	6,306	6,306	63.06			70	6,524	6,524	65.24
		80	6,133	6,133	61.33			80	6,265	6,265	62.65
	338	10	4,941	4,941	49.41		338	10	5,201	5,201	52.01
		20	5,318	5,318	53.18			20	5,555	5,555	55.55
		30	5,768	5,768	57.68			30	5.94	5.94	59.4
		40	6,112	6,112	61.12			40	6,219	6,219	62.19
		50	6,233	6,233	62.33			50	6,341	6,341	63.41
		60	6,233	6,233	62.33			60	6,341	6,341	63.41
		70	6,163	6,163	61.63			70	6,289	6,289	62.89
		80	5,842	5,842	58.42			80	6,066	6,066	60.66

The obtained results are shown in Table (8) that the adsorption process be very fastain the first minutes and then begin to slow down gradually until the adsorption reaches equilibrium, The adsorption process after the occurrence of equilibrium remains almost constant [14]. and the adsorption process reaches a speed in which the particles of the adsorbent are attached to the adsorbent surface equalaThe rate of emission of other molecules from the adsorbent surface into the solution is the so-called-(condition equanimity), and it was found pesticides under study It reaches equilibrium over time between(50-60) min, the time has been selected (60) accurate for the completion of subsequent studies after the state of equilibrium, decrease in the efficiency and capacity of adsorption was observed, due to the occurrence of the adsorption process [1, 15].

3.6.3 Effect of Initial Concentration

The effect of concentration, has been studied Bidet In a range of (10-50)ppm, and at different temperatures ranging from (298-338) K, after fixing all other variables affecting the adsorption process, at a constant speed (90 rpm) and using (0.1) g/l of prepared activated carbon for a period of (60) min, and at the natural pH function ($pH_{Natural}$). The results obtained from this study are included in Table (9).

Table 9: Effect of concentration on adsorption percentage and adsorption capacity of activated carbon at different temperatures of the chemical pesticides under study.

n	T (ºk)	Ci (mg/l)	Ce (mg/l)	Qe (mg/l)	% ads	*n*	T (ºk)	Ci (mg/l)	Ce (mg/l)	Qe (mg/l)	% ads
TRF T	298	10	3,139	6,861	68.61	GOL GO	298	10	2,704	7,296	72.96
		20	6,589	13,411	67,055			20	5,635	14,365	71,825
		30	10,257	19,743	65.81			30	9.111	20,889	69.63
		40	14,157	25,843	64,607			40	12,801	27,199	67,997
		50	18,518	31,482	62,964			50	17,151	32,849	65,698
	308	10	3,299	6,701	67.01		308	10	2,914	7,086	70.86

		20	6,818	13,182	65.91			20	6,158	13,842	69.21
		30	10,751	19,249	64,163			30	9,521	20,479	68,263
		40	15,112	24,888	62.22			40	13,313	26,687	66,717
		50	19,519	30,481	60,962			50	17,612	32,388	64,776
	318	10	3,385	6,615	66.15		38	10	3,149	6,851	68.51
		20	6,978	13,022	65.11			20	6,781	13,219	66,095
		30	11,151	18,849	62.83			30	10,773	19,227	64.09
		40	16,125	23,875	59,687			40	15,231	24,769	61,922
		50	21,179	28,821	57,642			50	20,139	29,861	59,722
	328	10	3,715	6,285	62.85		328	10	3,388	6,612	66.12
		20	8.101	11,899	59,495			20	7.23	12.77	63.85
		30	13.111	16,889	56,296			30	12,135	17,865	59.55
		40	18,135	21,865	54,662			40	17,852	22,148	55.37
		50	23,911	26,089	52,178			50	23,377	26,623	53,246
	338	10	4,013	5,987	59.87		338	10	3,795	6,205	62.05
		20	9,104	10,896	54.48			20	8,235	11,765	58,825
		30	14,215	15,785	52,616			30	13,103	16,897	56,323
		40	19,635	20,365	50,912			40	19,358	20,642	51,605
		50	24,611	25,389	50,778			50	24,101	25,899	51,798

The results obtained from this study indicate the following:

1. The adsorption efficiency decreases with increasing concentration, but the adsorption capacity (*qe*) increases with increasing concentration and the reason for this can be attributed to that increasing the concentration facilitates the mass transfer process to the surface of the adsorbent material, thus increasing the adsorption capacity, and on the other hand, increasing the concentration increases the number of molecules available for adsorption when the effective sites on the surface of activated carbon are limited, This increase in the number of molecules caused by the increase in concentration leads to increased competition among them to bind to a fixed number of effective sites on a fixed amount of the adsorbent, and thus leads to a larger amount of the adsorbent being left behind in the solution, and thus the amount of the remaining substance in the solution is greater with As the concentration increases, the adsorption efficiency decreases [16].
2. At a fixed concentration, the adsorption efficiency and capacity decrease with increasing temperature, and through our observations, in general, of high adsorption efficiency and capacity values at low concentrations and temperatures, we deduce that the study of the adsorption process is more efficient and sensitive at low temperatures, which represent normal environmental conditions, which gives us economic support for not having to provide industrial units for its completion, as well as its efficiency. Low concentrations make it more important, as most of the risks of pesticide contamination lie in low concentrations due to non-discrimination and avoidance by the consumer.
3. If we want to compare the same adsorbent materials from where The effect of concentration at different concentrations and at a temperature ranging between (298-338) absolute. We note that the capacity and adsorption efficiency increase as in the order following (GOL > TRF)When trying to explain all of the above, we resort to the difference in the values of the pH function, as well as the difference in the molar mass of adsorbents and the structural difference of pesticides, especially the presence of effective aggregates in their composition, which affect through the inductive factor or interference with the adsorbent surface aggregates, despite the presence of fluorine and chlorine aggregates. (F^{-1}, CL^{-1}) the large size of them and the presence of nitrogen atoms made them affect the adsorption capacities of the studied pesticides, and this is consistent with previous studies [1].

3.6.4 Effect of pH

The effect of the (pH- function) has been studied, especially that the capacity and efficiency of adsorption is greatly affected by the nature of the medium in which it is adsorbed, and for the purpose of determining the best acid function in which the materials under study are adsorbed, adsorption has been studied in three different media, the acidity function, including the natural acidity function (*pH) for each adsorbent, as well as at the acidity function (4 & 9), with all other conditions constant, including concentration and temperature (298) absolute, and the weight of the adsorbent (0.1) g. The obtained results are included in the table below.

Table 10: Effect of pH function on adsorption capacity and adsorption percentage for the materials under study when using activated carbon.

n.	**pH**	**Wt (gm)**	**Ci (mg/l)**	**Ce (mg/l)**	**Cads (mg/l)**	**qe (mg/g)**	**% ads**
TRF	6.4*	0.1	10	3,062	6,938	6,938	69.38
	4	0.1		2,408	7,592	7,592	75.92
	9	0.1		3,719	6,281	6,281	62.81
GOL	6.7*	0.1	10	2,701	7,299	7,299	72.99
	4	0.1		2,011	7,989	7,989	79.89
	9	0.1		3,125	6,875	6,875	68.75

When looking carefully at the results shown in Table (10), we notice that the adsorption process Chemical pesticides The surface adsorption of activated carbon in acidic media is higher than its adsorption in neutral media(normal function)This, in turn, is higher than adsorption in alkaline media. the effect of the acidity function on the adsorption efficiency, can be explained by the fact that the net charge on the surface of activated carbon in aqueous solutions is negative [17], as well as the fact that pesticides contain aggregates that make them susceptible to being affected by the nature of the medium in which they are present (OH). and as a result lead to the formation of the phenoxide ion that pushes the charge towards the aromatic ring, and leads to its spread over the entire molecule and thus the resulting negatively charged molecule will repel and move away from the surface of the prepared, activated carbon charged with the negative charge, based on the rule of similar charges repel and result in a decrease in the efficiency And adsorption capacity, on the other hand, the transformation of the hydroxyl group into the phenoxide ion, generating a negative charge on the oxygen atom, increases the solubility of the molecule in the solvent and makes it more inclined towards molecular interactions and the formation of hydrogen bonds in the adsorption medium, thus weakening its adsorption efficiency, In the acidic medium, there will be an abundance of protons (the positive charge), so the phenol groups will turn into the positively charged phenoxonium ion based on the base of the different charges attracting, thus increasing the bond between the adsorbent and the adsorbent surface, thus increasing the adsorption and reducing the interference of the adsorbent with the solvent molecules [18, 19], the adsorption capacity and efficiency of pesticides is as high as possible in an acidic medium.

3.6.5 Effect of temperature on adsorption

A study of the effect of temperature, was conducted for the adsorption of the adsorbents under study on the surface of activated carbon, the obtained results were included in tables (11) and at the ($pH_{Natural}$), shaking time (60) min, weight of activated carbon samples (0.1) gm, constant speed (90) cycle/min.

Table 11: The effect of temperature on, the adsorption capacity and the percentage of pesticides adsorption (%) (GOL & TRF) on activated carbon.

n	Ci mg/l	T (ºk)	Ce (mg/l)	Qe (mg/l)	% ads	*n*	Ci mg/l	T (ºk)	Ce (mg/l)	Qe (mg/l)	% ads
TRF	10	298	3,139	6,861	68.61	GOL	10	298	2,704	7,296	72.96
		308	3,299	6,701	67.01			308	2,914	7,086	70.86
		318	3,385	6,615	66.15			318	3,149	6,851	68.51
		328	3,715	6,285	62.85			328	3,388	6,612	66.12
		338	4,013	5,987	59.87			338	3,795	6,205	62.05
	20	298	6,589	13,411	67,055		20	298	5,635	14,365	71,825
		308	6,818	13,182	65.91			308	6,158	13,842	69.21
		318	6,978	13,022	65.11			318	6,781	13,219	66,095
		328	8.101	11,899	59,495			328	7.23	12.77	63.85
		338	9,104	10,896	54.48			338	8,235	11,765	58,825
	30	298	10,257	19,743	65.81		30	298	9.111	20,889	69.63
		308	10,751	19,249	64,163			308	9,521	20,479	68,263
		318	11,151	18,849	62.83			318	10,773	19,227	64.09
		328	13.111	16,889	56,296			328	12,135	17,865	59.55
		338	14,215	15,785	52,616			338	13,103	16,897	56,323
	40	298	14,157	25,843	64,607		40	298	12,801	27,199	67,997
		308	15,112	24,888	62.22			308	13,313	26,687	66,717
		318	16,125	23,875	59,687			318	15,231	24,769	61,922
		328	18,135	21,865	54,662			328	17,852	22,148	55.37
		338	19,635	20,365	50,912			338	19,358	20,642	51,605
	50	298	18,518	31,482	62,964		50	298	17,151	32,849	65,698
		308	19,519	30,481	60,962			308	17,612	32,388	64,776
		318	21,179	28,821	57,642			318	20,139	29,861	59,722
		328	23,911	26,089	52,178			328	23,377	26,623	53,246
		338	24,611	25,389	50,778			338	24,101	25,899	51,798

The results contained in Table (11) can be discussed according to the following points:

1-In general, at a fixed concentration, we notice that increasing the temperature of the adsorption medium from (298-338) K leads to a decrease in the adsorption efficiency and adsorption capacity (qe) and regardless of the nature the material the adsorbent, as the increase in temperature leads to an increase in the process of returning particles of the adsorbed substance from the adsorbent surface to the solution (Desorption) [20]; Because of the breaking of the forces that link the adsorbent and the adsorbent surface, and this indicates that the adsorption process is a heat-emitting process (Exothermic) [21], which indicates the physical nature of adsorption in the studied system, and this statement applies exactly to Le Chalet's rule [14], It has been observed that the temperature (298) Kelvin is the best temperature for adsorption, and this is confirmed by previous studies [1, 22].

2-At a constant concentration and a constant temperature, we notice a difference in the efficiency and adsorption capacity of the materials under study. The reason for this may be due to the presence of some functional groups, their attachment sites and their number, as well as the nature of the steric form that pesticides take, the equanimity of the molecule, the nature of the succession of double bonds in it, the difference in their molecular weights, and the nature of the acid function [15].

Based on the foregoing, the conclusion that can be drawn from the study of the effect of concentration, pH function, and water temperatureBidatIt is that the adsorption of materials weakens with increasing temperature,And the optimal conditions for the adsorption of pesticides require an acidic medium, which is the natural medium for the materials, and the temperature required to achieve a high rate of adsorption is within the limits of normal temperatures (25 °C), which gives great importance and economic support.

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