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Research Article

Preparation And Identification NanoActivated Carbon from The Date Seeds And Pomegranate Peels.

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** *Related declarations are provided in the final section of this article.*

Abstract

The research included preparing activated carbon and nano scale from the date seeds and pomegranate peels. The preparedcharcoal was diagnosed using different techniques such as the UV-Vis spectrum , infrared spectrum (FT-IR), X-ray diffraction (XRD), the Scanning electron microscopy (SEM), as the results of the UV-Vis spectrum showed that activated charcoal it was observed that the absorption spectrum of the C-NPs particles was 400 nm , as the resultsof FT-IR spectrum showed that the activated charcoal did not contain any combination effective , that is , it is chemically inert, as the results of both (XRD) and (SEM) showed the minute volume of activated charcoal within the range approxant to the nano scale siz 11.08nm and the shape of the (pores) on the surface of the prepared activated charcoal bearing the properties of the nanomaterial with their properties, and some physical properties were also studied. coal such as the percentage of moisture, density and acidic function and the percentage of ash content , where it has a percentage of which has up to (3.3%), the density of (0.394 g/cm^{-1})) and the ash content was (5%) while the PH(7) function.

Keywords: activated charcoal, nano, absorption , date seeds and pomegranate peels.

Introduction

Activated carbon is a dark material that has good adsorption properties with stable chemical properties and strong acid and alkali resistance as well as high resistance to high temperatures.Activated carbon manufacturing process activated carbon is produced from raw materials with a high carbon content (natural materials) such as trees coal and some agricultural water[1].Adsorption is one of the important and most widely used techniques in removing pollutants from their aqueous solutions because of its high efficiency and the simplicity of the technology used compared to other methods as well as its low economic cost.Effectiveness of adsorption on the surface of nanoparticles:Nanoparticles and some metal oxides constitute effective adsorbent materials with high efficiency in treating environmental pollution. Active carbon silice and grapheme oxide were used which have proven to be highly efficient due to their unique two-dimensional nature represented by the presence of functional groups and their large surface area.It is prepared in two stages:

The first stage: carbonization

At this stage the raw material is converted into carbon mass through heating in isolation about the air.

The second stage: Activation In this stage oxidizing gases such as water vapor and carbon dioxide are used at high temperatures and gap structures are formed inside the carbon.

The micro gaps are responsible for the efficiency and capacity of active carbon. Active carbon works through a process called adsorption and in order to learn about this process you must know the following :

Adsorbate (pollutants):these are the elements or pollutants present in water that are adsorbed on the surface of the adsorbent material.

Adsorbent (active carbon): it is the solid substance on its inner surface is adsorbed[2,3].

The nanoparticle method is one of the most effective and most efficient technology in dealing with this problem is due to the small size of these particles and their penetration into the pollution , and then the adsorption process occurs to obtain good water purification. The adsorbent surface is natural , cheap available environmentally friendly and does not require additional treatment steps. One of the first steps that must be in place for an effective adsorption

process is to obtain adsorbent surfaces characterized by high selectivity ability large as well as high surface area it must also be low cost and available[4-6].

The researchers (Muhammad Hussein Al-Rasshdi and Imad Abdul-llah Al- Hayali. 2023), were also able to prepare a mixture by converting waste at the lowest natural cost in an inexpensive way at a low cost into a substance used for smoking. Carbon was included in the study through measurements (XRD, SEM, BET , EDX)[7].and was also able to study**(Liqaa Hussein Alwan Al-samarrai. 2018),** activated charcoal prepared from palm leaves was prepared as a new adsorbent that used the drug (ponstan) Mefenamic acid and the ultra-light extinguishing technique in order to monitor the adsorbed quantities after the occurrence of chest tightness with the prepared activator the treatment process was carried out according to different temperatures (10, 15 , 25, 35 , 45° C) and the thermodynamic functions of the adsorption process were calculated (Δ H ,Δ G and Δ S)the study shown that the process of adsorption of the drug ponstan on the surface of the prepared stimulant takes place at low concentrations and the adsorption increases after combined concentrations of the drug. The amount of adsorption decreases at temperature which indicates that reaction is exothermic[8].and was also able to study **(Tariq Al-Asadi.2022),**the adsorption prepared from banana stems and leaves (BSL-BC) at 400 degrees [9],were also able to prepare activated charcoal by **(Mohamed HassanAhmed et al. 2023),**from the caper plant by drying the capparisspinosa plant grinding it chemically activating it and then carbonizing it with an atmosphere. A nitrogen carrier with degrees ranging between 600 − 800℃ [10].

2.Objectives of the study:

Preparation a new adsorbent material of environmentally friendly nanomaterial using nanotechnology and Diagnosis of nanomaterial prepared using known nanotechniques namely : UV-Vis / FT-IR / SEM/ XRD.

3.Materials and Methods

3.1.Instrument

Using : UV-Vis spectrophotometer type of Scinco / S-3100 , USA.

Fourier-transform Infrared spectrophotometer (FT-IR) type of PerkinElmer / UATR Two Spectrum Two , USA.

X-ray crystallography type of D2 phaser 2nd gen/ BRUKER , Germany.

Scanning electron microscopy (SEM) type of SEM connected with BRUKER for energy dispersive spectroscopy (EDS) / TESCAN VEGA3 , Germany.

Sensitive Balance type of OHAUS , Japan.

3540PH & Conductivity Mater type of JENWAY , China.

Furnace type of Barnstead Thermolyne BL Furnace 47900 , USA.

Dry furnace type of J.P. SELECTA,s.a. , SPAIN.

3.2.Chemical Materials

date seeds and pomegranate peels.

Sodium hydroxid (NaOH). (0.1 N)

Hydrochloric acid about 35% pure (HCl). (0.1 N)

Distilled water.

3.3.Preparing the raw material

Washed the date seeds and pomegranate peels with water several time to clean them from the suspended dust , then washed them with ion-free water several times for the purpose of getting rid of impurities and confirmed from free of vulnerability , they were sliced into almost 2cm length and placed in an electric dried furnace with a temperature of 50℃ degrees for three hours , in order to dried it and rid it of moisture ,then grind it to obtain a powder of date seeds and pomegranate peels as inFigure 1 and 2.

Figure 1.shows date seeds and pomegranate . © Photography by the researcher.

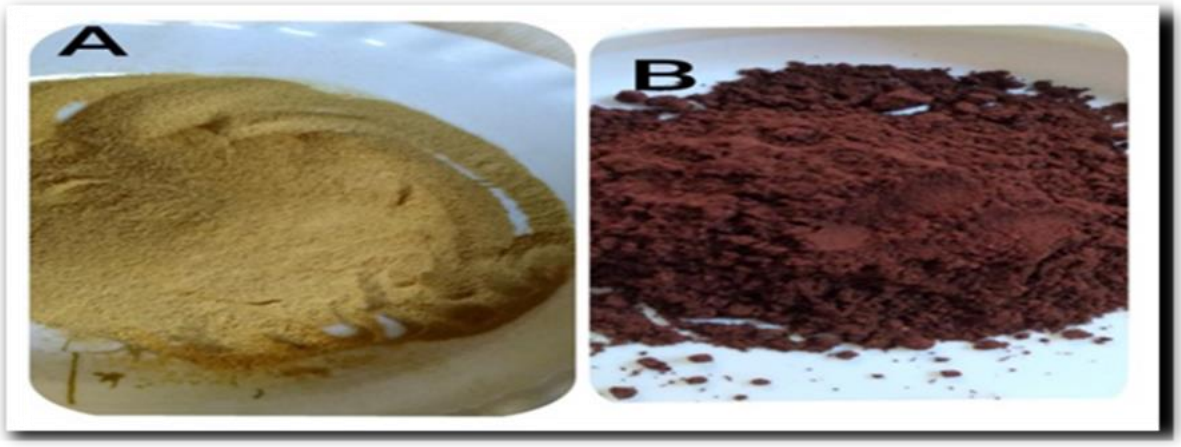

Figure 2.shows A. powder of pomegranate and B. powder of date seeds. © Photography by the researcher.

3.4.Preparation of activated charcoal from date seeds and pomegranate peels powder in two stages :

<u>The first : the charring stage :</u>

Carried out the carbonization process by taked (40g) from date seeds and pomegranate peels powdered after dried them by burned them inside the burned oven at 500℃ for two hours. The powder of date seeds and pomegranate peels were extracted after they were carbonized and then cooled by Desiccator at room temperature as in Figure 3.

Figure 3.the powder of mixture date seeds and pomegranate peels after the carbonization process.© Photography by the researcher.

The powder of date seeds and pomegranate peels were extracted after they were carbonized and then cooled by Desiccator at room temperature as in figure 4 and 5 [11]. The sample was prepared in the master laboratory / Department of pharmacology / college of pharmacy/ university of Aden / khormaksar district / Aden Governorate / Yemen

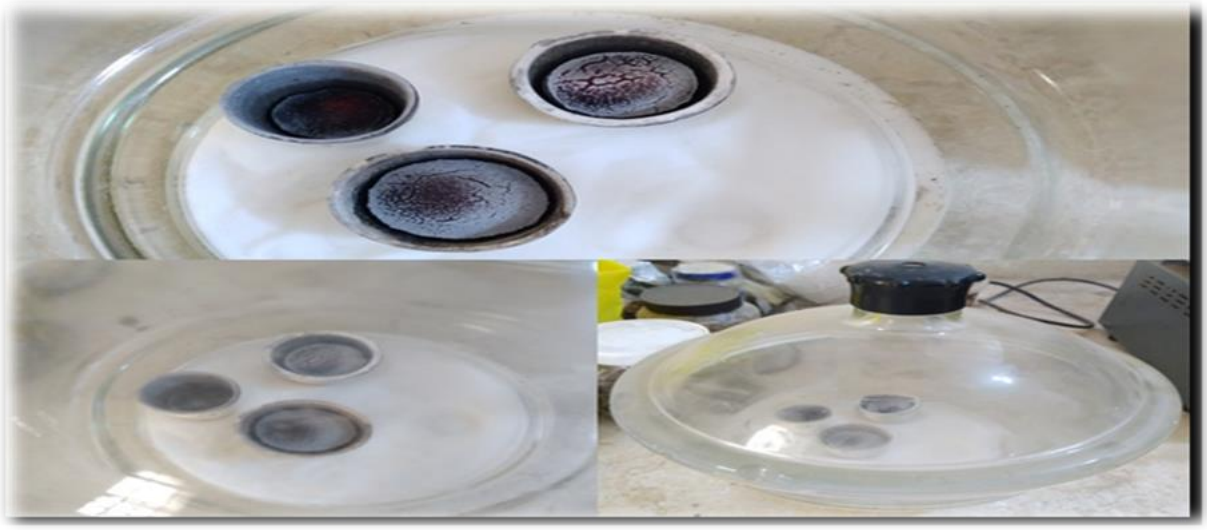

Figure 4.the powder of mixture date seeds and pomegranate peels before the carbonization process and cooled by Desiccator and at room temperature.© Photography by the researcher.

Figure 5.the activated charcoal after the carbonization process. © Photography by the researcher.

The Second : the activation stage:

Where 20g of carbonated date seeds powder and pomegranate peels were carefully weighed , where they were activated by the process by added 12g of NaOH solution to the powder

resulting from the carbonation process , where the content was mixed in the beaker in a manner complete. The homogeneous mixture was placed inside the burned furnace for two hours at a temperature of 800℃ degrees. then the resulted activated charcoal was cooled and washed with deionized water several times as inFigure 6. then the activated charcoal was neutralized with 0.4ml of hydrochloric acid HCl to obtain neutral activated charcoal , then the activated charcoal was dried for three hours at 50℃ degrees as in Figure 6 and 7.

Figure 6.[A],[B],[C]and [D] show the steps of activation process by NaOH for the carbonated date seeds powder and pomegranate peels resulting from the carbonation process activated charcoal. © Photography by the researcher**.**

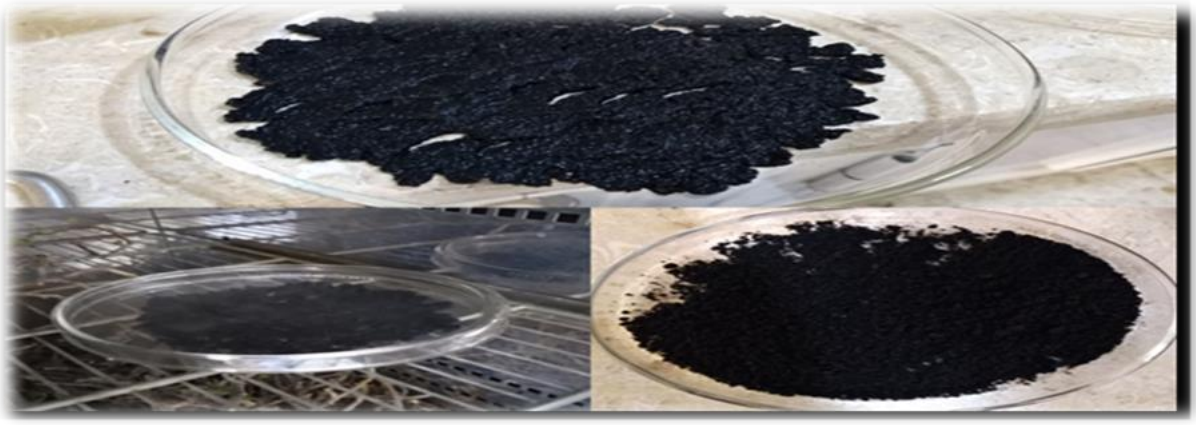

figure 7. Show the activated charcoal was neutralized by HCl then dried. © Photography by the researcher.

figure 8.[A] The date seeds and pomegranate peels powder after the carbonization process. [B] The activated charcoal. © Photography by the researcher.

4.5.Take some measurements to evaluate the properties of coal prepared tonic :

3.5.1.Determination of moisture content :

Weighed (1g) of activated charcocal prepared in a previously weighed ceramic flask , and placed in a drying oven at 110℃ for three hours. the sample was placed in the desiccator and left to cool at room temperature , after which it was weighed , than the peroentage of moisture was calculated.

3.5.2.Determination of the percentage of ash :

Weight (2g) of the prepared activated charcoal and placed in a previously weighed ceramic lid , then the lid was placed in the burned furnace at 500℃ for four hours . put the eyelid in the dried and left it to cool at room temperature , then weigh it used a sensitive scale , according to the percentage and according to the weight of the remaining ash and for the ash was calculated.

3.5.3.Measuring the density of the prepared charcoal:

Putted an amount of the prepared activated charcoal in a 10ml volumetric vial, so that the activated charcoal occupied the volume of the vial to the mark . then make the coal particles one level at the edge of the mark by lightly tapped the sides of the bottle .then weigh the prepared charcoal in the volumetric bottle used a sensitive balance , and calculate the density from the followed relationship:

Density(g/cm^3) = mass/volume……(1)

3.5.4.Determination of the PH of the prepared activated charcoal:

Added 1g ounces of activated charcoal to 10ml of distilled water , then shake the solution for half an hour, Used a rocking device at a temperature of25℃ , then filtered the solution and measured the PH of the filter used a PH measured device [11].

4.Results and Discussion:

4.1. Some measurements has been taken to evaluate the properties of coal prepared tonic:

4.1.1.Humidity measurement evaluation:

It is known that the permissible range of moisture content of activated carbon should be less than 10% [12] , in this work the moisture content of the prepared activated carbon was calculated and it was found that the prepared carbon contained a moisture content of (3.3%).

4.1.2. Ash content measurement evaluation :

The ash content was calculated as (0.1 g) at a percentage of (5%) as this percentage is considered within the percentages permitted in the specifications of global and commercial activated carbon as the ash content usually ranges from 1-5 % of the original coal [13].

4.1.3.Evaluation of the density measurement of the prepared activated charcoal :

In this study it was found that it has a high density(0.394 g/cm^3) which indicates the high efficiency and adsorption capacity of the prepared nano- activated carbon.

4.1.4.Evaluation of the acidity function using a PH meter:

The prepared nano-activated carbon filtrate was measured and the PH value was (PH = 7) , which indicates that the prepared nano-activated carbon is neutral which is of the good properties of activated carbon.

4.2.Characterization of Prepared Nanomaterial:

4.2.1.UV-Vis Spectroscopy:

The results of this study showed that the nano-activated charcoal particles C-NPs were found by examining the UV-vis spectrum in the range (300 – 800 nm) it was observed that the absorption spectrum of the C-NPs particles was 400 nm[14] , as shown in figure 9.Workplace the samples were examined in the laboratory of the General Authority for Drugs and Medical Supplies / Khormakser District / Aden Governorate / Yemen.

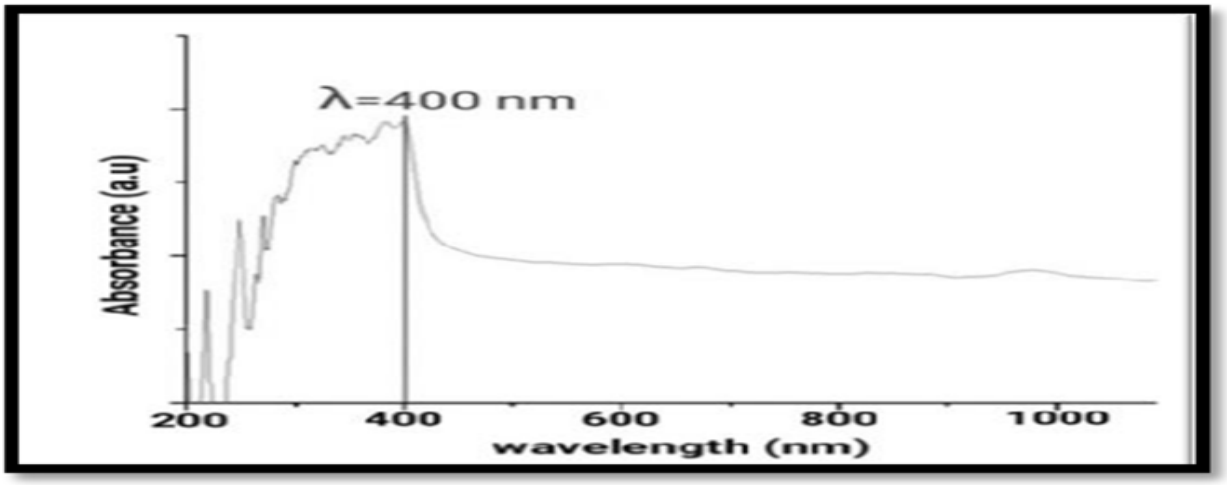

Figure 9.UV spectrum of the nano-activated charcoal solution C-NPs.

4.2.2.Infrared Spectroscopy (FTIR):

When comparing the FTIR spectrum of the two samples [A] a mixture of date seeds and pomegranate peels before the burning shown in figure 10with [B] a mixture of date seeds and pomegranate peels after the burning shown in figure11, the FTIR measurement of the mixture of date seeds and pomegranate peels before the burning shown many bands as shown in table No (1) which shown the frequency of each band and the type of bond before burning [15]. workplace the samples were examined in the laboratory of the General Authority for Drugs and Medical Supplies / Khormakser District / Aden Governorate / Yemen.

Table 1 : FTIR spectrum bands of the mixture of date seeds and pomegranate peels before burning [A].

	Frequency (cm^{-1})
Mt (O – H)	3282
Mt (C – H) Aliphatic	2923
(C = N) Azomitin	1602
Mt (C – N)	1011

Measuring the infrared spectrum (FTIR) of the mixture of date seeds and pomegranate peels after carbonization at 500℃ , it was observed that many bands disappeared and new bands appeared as shown in table No2. which shown the frequency of each band the type of band after burning and the shapes (10,11)

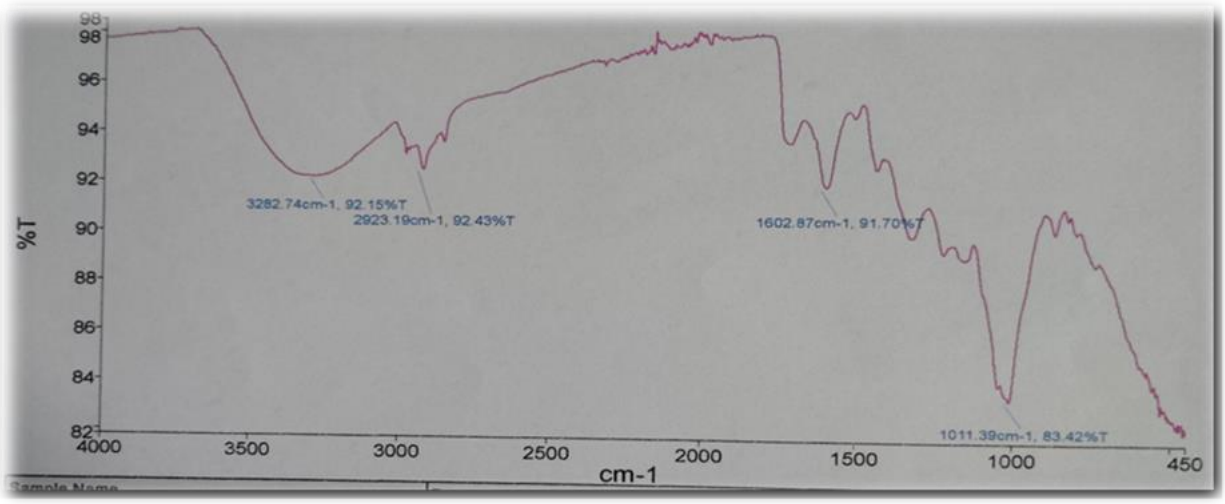

Figure 10.FTIR spectrum bands of the mixture of date seeds and pomegranate peels before burning [A].

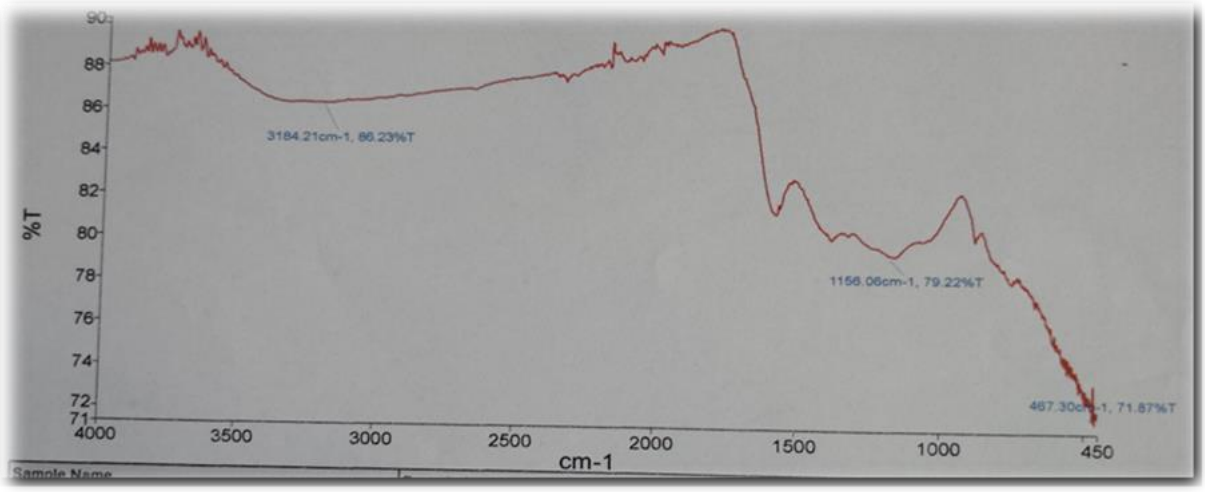

Figure 11.FTIR spectrum bands of the mixture of date seeds and pomegranate peels after burning [B].

When measuring the infrared spectrum (FTIR) of the mixture of date seeds and pomegranate peels after activation by adding sodium hydroxide (NaOH) at a temperature of 800° C, it was observed that almost all the bands disappeared as shown in the figure 12., which indicates complete burning because it is chemically inert.

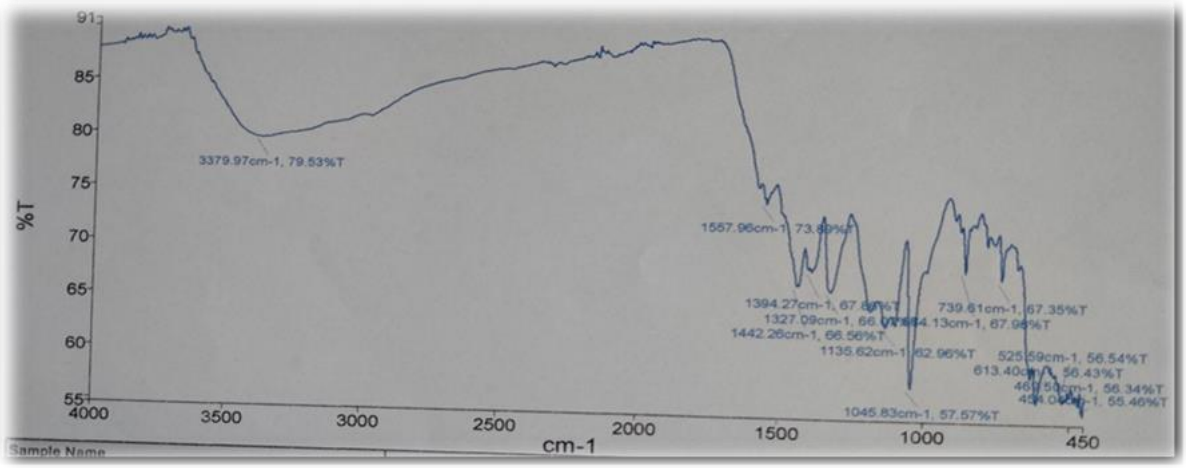

Figure 12.. FTIR spectrum bands of the mixture of date seeds and pomegranate peels after activation.

When measuring the infrared spectrum (FTIR) of the date seeds and pomegranate peels thread after activation and neutralization and obtaining the nano-activated carbon (C-NPs) , it was observed that almost all the bands disappeared and new bands appeared as shown in the figure

13., which indicates the combustion of the material and the formation of nano- activated carbon (C-NPs).

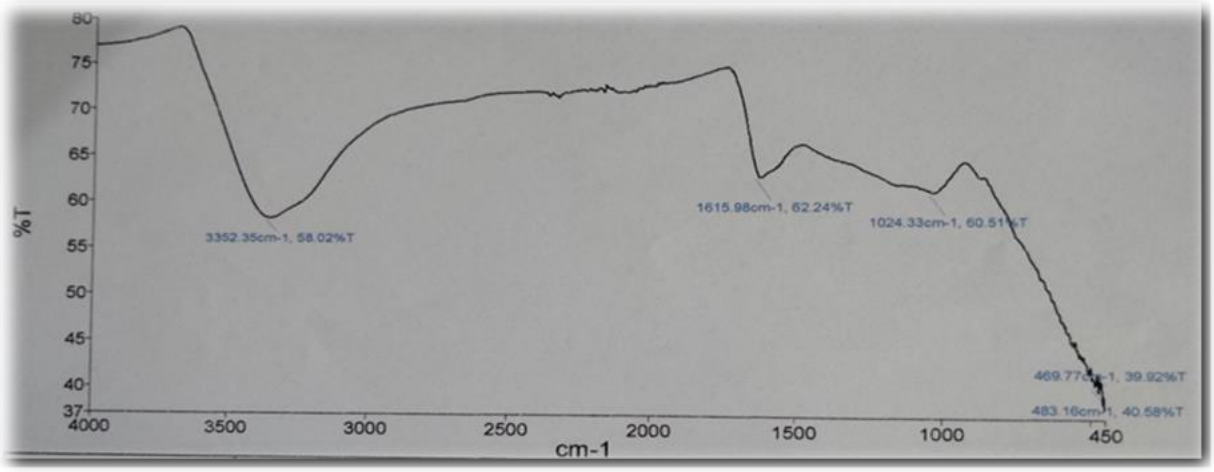

Figure 13.FTIR spectrum of nano-activated carbon C-NPS.

5.2.3.X-Ray Diffraction (XRD):

The crystal structure and phase purity of the prepared nano- activated charcoal nanoparticles (C-NPs) were characterized by X-ray diffraction as shown in figure 14. Nanoparticles matches the standard spectrum of nano- activated charcoal nanoparticles according the crystalline composition of the nano-activated charcoal nanoparticles (C-NPs) was detected by diffraction peaks on (31.233 , 45.496 , 65.871 , 75.168). The average crystalline size of the nano- activated charcoal nanoparticles was calculated and was in nanometers 11.08nm using the Debye-Scherer [16]. As shown in equation 1 and table 2. workplace National Research Centre / Cairo/ Egypt.

$$\mathbf{D_{av} = \frac{k\lambda}{\beta \cos\theta}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$\boldsymbol{D_{av=}}$ Average crystalline size (nm).

K = constant dependent on crystal structure = (0.9).

λ=x-ray wavelength1.54060Å).

β =FWHM mid-peak. (Full Width at Half Maximum).

θ =Bragg angle.

Table 2. shown the calculation of the average crystalline size of nano- activated charcoal nanoparticles according to Debye's Scherer law.

k	ʎ(Å)	Peak no.	Peak Position $2\theta(°)$	FWHM βsize (°)	D_P nm	D_p Average (nm)
0.9	1.54060	2	45.496	0.327	1.38nm	11.08nm
		1	31.233	0.624	12.51nm	
		3	65.871	0.408	19.36nm	

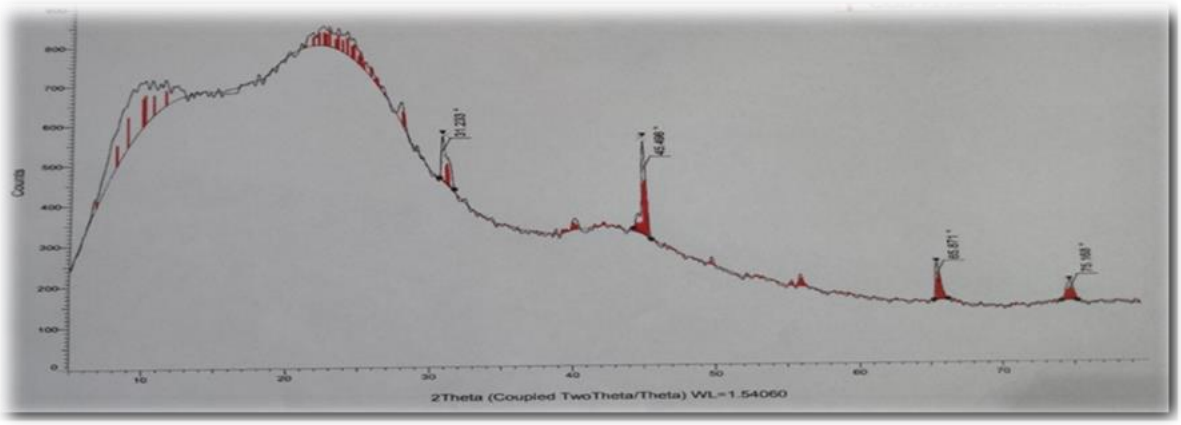

Figure 14. The X-a-ray diffraction spectrum of the prepared nano- activated charcoal.

5.2.4 Scanning Electron Microscopy (SEM):

The morphological and structural properties of nano- activated charcoal (C-NPs) were observed using scanning electron microscopy (SEM). Figure 15.shown that the nanoparticles were prepared in the nanometer range. The SEM images indicated that some nanoparticles were well separated from each other , while most were present in a clumped form. This clumping is due to electrostatic effects in addition to the German slurry effect , revealing agglomeration behavior of the nanoparticles. This behavior is consistent with similar agglomeration behavior of nanoparticles in previous studies [17,18]. workplace National Research Centre / Cairo/ Egypt.

Figure 15. Characterization of nano- activated charcoal by SEM.

5.Conclusions:

1. The study shown that the used nanomaterial prepared using less expensive and environmentally friendly methods possess good properties and high efficiency , namely nano-activated carbon.

2. These material was characterized using various techniques such as : UV-Vis , FTIR, SEM, and X-ray which revealed the properties and topographical features of the prepared nanomaterial in terms of the crystalline plane , particle

6.Recommendation:

1. .The future use of nano-activated carbon in broad industrial and medical applications.

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