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Original article

THE IMPACT OF ORGANIC RESIDUES ON LEAD ADSORPTION IN TWO TYPES OF CALCAREOUS SOILS

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Abstract

The experiment was conducted in the laboratories of the University of Agriculture in Basra University. The study included investigating the behavior of lead adsorption in soil samples at equilibrium conditions and factors affecting adsorption by organic residues (animal and plant) Soil samples were taken from two different locations in Basra State (Al-Zubair and Kutayban). A laboratory experiment was conducted in which five volumes of mg L^{1-} of lead (20-40-80-160-200) were added to each soil sample, with three modified for the Langmuir and Freundlich equations of the adsorption system was used to describe the nature of lead adsorption in the soil sample under investigation. The study concluded that the rate of adsorption increased with increasing amount of lead added, and the change in soil adsorption capacity was responsible for differences in chemical and physical properties of experimental soil of the species, represented by calcium carbonate concentration, organic matter, clay content and type, pH, and ionic strength.

Keywords: Wheat straw; Cow manure; Langmuir; Freundlich

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Introduction

Heavy metals are considered one of the most dangerous substances present in soil due to their long-term persistence without degradation. Heavy metals exist as natural components in the earth's crust and are non-biodegradable, tending to become pollutants for various living organisms in the environment [1]. One of the most important forms of heavy metals in soil is the readily available form, as it determines the extent of its impact on soil pollution and is the easiest form to be absorbed by plants. It also determines the effectiveness of ions in pollution and their entry into the food chain, affecting the health of both humans and wildlife [2]. The increase in heavy metal elements in the environment is attributed to the non-degradation of these elements, leading to their persistence in the environment [3]. Environmental pollution is one of the world's most serious problems, especially in developing countries, the agricultural use of untreated wastewater, the use of agricultural fertilizer and car exhaust, among the main sources of environmental pollution. These materials may contain heavy elements that may be toxic or have a detrimental impact on plants and depend on the nature of the elements and their bioavailability [4]. (Uddin, 2017) pointed out that concentrations of heavy metals such as lead, nickel, and cadmium increase in soils near industrial facilities such as oil refineries and power plants [5] . Due to poorly studied agricultural practices, some substances and chemicals used in agriculture are the main sources of heavy metals in the soil [6].

The risk of heavy metals in soil and water is based on the fact that these compounds are not biodegradable, unlike naturally occurring pollutants which decompose in the environment, these pollutants are dormant released in the environment accumulating and degrading Sources include automobile emissions, mineral refining, coal and chemical manufacturing , airborne lead dust, pesticides agricultural uses, and contaminated water for irrigation Lead is a heavy metal with low corrosion resistance and easy coating. It can be combined with other materials to make alloys [7]. Lead is considered an environmental pollutant, and its sources include battery manufacturing, power lines and pipes and other industrial applications. Coatings containing lead in soil, as well as lead-containing fuels, engine oils, pesticides and incinerators contribute to lead pollution [8]. Facinelli et al. (2001) clarified that naturally occurring and continuously low heavy elements resulting from weathering and pedogenic processes in the parent rocks [9,10]. Lead Pb melts at 327.5°C [11]. It has group 14, period 6 in the periodic table, and has a dark gray color, atomic number 42, density 11.34 g $(cm^3)^{-1}$, atomic weight 207.2 g mol^{-1}, and boiling point of 1749°C [12]. Lead is considered as one of the hazardous elements in the environment, which has a significant impact on human health, causes diseases and does not contribute to any basic functions in the body [13]. Makino *et al*. (2010) highlighted that soil and water pollution occurs without appropriate solutions and treatments for mining, industrial and waste disposal, affecting agriculture and ecosystems [14]. Adsorption is defined as the accumulation of a substance at the interface between a solid phase and an aqueous solution, and operates in most biological, chemical, and biological environmental systems, controlling reactions and properties weight of the soil [15]. The adsorption concept is widely used and currently considered as one of the best methods because of its low cost and efficiency [16,17,18,19]. The adsorption of heavy metals involves multiple processes, including ion exchange and specific and nonspecific adsorption. Moreover, two types of forces affect adsorption (chemical and physical forces). Physical properties include van der Waals and ion exchange, while chemical forces include ionic or covalent interactions. Differences in soil texture have an important effect on the presence of ready-made lead in the soil. Al-Kudor *et al*. (2017) showed that the amount of lead adsorbed in sandy soils is much lower than that adsorbed on the surface of clay soil particles and this is due to the increased cation exchange capacity (CEC) of clay soils [20]. The characteristics of clay minerals also affect the composition of lead in soils, compared to other minerals, illite minerals show a strong affinity for the adsorption of lead Using thermosymmetric adsorption isotherms can reveal the amount of material clay adsorb in equilibrium revealed, which can be mathematically described by the thermal so isotropy equation [21] .

Material and method

Soil samples had been accrued at an intensity of zero–30 cm from web sites in Basra Governorate, Al-Zubair (sandy loam) and Kutayban (clay loam), with exceptional chemical and physical residences. The soil samples have been air-dried, then gravel and impurities had been removed, accompanied by way of grinding and sieving through a sieve with a diameter of two mm openings. Some initial soil properties had been measured, as shown in table 1. Two types of organic residues, animal residues (cow manure) and plant residues (wheat straw) were selected and fermented for 90 days. After the end of fermentation period, these residues were air-dried and after the drying process was completed, and sieving through a sieve with a diameter of one (mm) openings and some chemical analyses were conducted, as shown in table (2).

Table 1.

Some physical and chemical properties of the studied soil

Properties	Soil		Unit
	Al-Al-Zubair T1	Kutayban T2	
pH	7.60	7.45	-
Ec	4.72	5.00	ds m^{-1}
CEC	10.12	20.22	C $mole^{+}$ kg^{-1}
O.M	3.75	5.62	g kg^{-1}
Carbonate minerals	291.51	372	g kg-1
Dissolved positive Ions			
Ca^{+2}	7.92	14.38	mmol L^{-1}
Mg^{+2}	6.79	5.52	
Na^{+}	17.25	6.5	
K^{+}	1.25	3.74	
Dissolved negative Ions			
SO_4^{-2}	8.91	13.37	mmol L^{-1}
Cl^{-}	30.72	19.5	
HCO_3^{-}	1.30	3.52	
CO_3^{-}	0	0	
Soil particle size			
Clay	90.31	136	gm kg^{-1}
Silt	50.48	419.2	
Sand	860	445	
Texture	Sandy loam	Silty loam	-

Table 2.

The chemical properties of the organic materials (plant residues and Cow manure) that have undergone fermentation

Properties	Wheat straw	Cow manure	Unit
pH	7.81	6.80	-
EC	4.5	6.9	ds m^{-1}
O.M	606.72	530.5	g kg^{-1}
Total organic Car-bone	351.90	307.71	g kg^{-1}
Total N	24.5	19.20	g kg^{-1}
Total P	1.92	8.5	g kg^{-1}
C/N	14.36	16.03	-
C/P	183.28	36.20	-

The adsorption test turned into performed to observe the adsorption of lead within the look at soil. Based at the variant in lead content material, 2 grams of every soil pattern were taken after the incubation length of the studied soil samples with ranges of animal residues (cow manure) and plant residues (wheat straw). They have been located in 100 ml plastic tubes, and degrees of lead (20-40-80-100- 160-200) mg L^{1-} of lead have been introduced to each soil sample. The volume became then finished with distilled water to 50 ml. These units were repeated for every soil pattern, and the tubes had been sealed and shaken for 2 hours on a mechanical shaker at a temperature of 25°C for each soil pattern one by one. This resulted in a complete of 081 experimental units (2 x 5 x 2 x3 x3) (soil kind * lead degrees * sort of residues * residue level * replicates).

After every shaking duration, the soil pH response of the solution changed into measured, and the equilibrium solution changed into separated from the soil by filtration. The lead attention turned into determined using atomic absorption spectrophotometers (A.A.S.). Then, the amount of adsorbed lead on the soil surface was calculated using the following formula:

$$\mathbf{q = (C0 – C) XV/W}$$

The amount of lead adsorbed per unit surface (q) in µg gm^{-1}. CO: Initial lead concentration in mg $L^{-1.}$ C: Lead concentration in the equilibrium solution in mg L^{-1}. V: Total extraction solution volume W: Soil weight in grams.

To recognize the character of lead adsorption and describe it mathematically, and given the general pollutants publicity of Basra soils and agricultural soils in particular, the intention of this have a look at is to check the impact of available herbal substances (natural residues) at the adsorption and launch of lead, lessen its harmful impact on soil and plants, and develop an green mathematical description of lead dynamics, figuring out the adsorption constants in line with adsorption equations. Langmuir Equation: This equation, evolved by using scientist Langmuir in 1918, is one of the only and most widely carried out equations to describe thermal symmetry adsorption. It assumes that adsorption occurs in a single layer of molecules on a homogeneous adsorbed surface, wherein the adsorption power is the same for all web sites. Once an element occupies websites at the adsorbed material, no different elements take their region. Additionally, the attraction forces among molecules lower with distance, and there aren't any side reactions between the adsorbed elements on the web sites. Freundlich Equation: This equation turned into developed by the scientist Freundlich in 1959 to describe gas adsorption on strong surfaces with a view to calculate the Freundlich constant value. The Freundlich equation became used to explain ion adsorption, at the same time as the Langmuir equation failed to describe adsorption experiments for some ions [22]. This equation is one of the adsorption equations applied to multilayer adsorption, assuming that the adsorption cloth floor consists of non-homogeneous sites, supplying an expression that determines the surface heterogeneity and the regular distribution of lively web sites and their energies. The replacement technique happens at the strongest binding energy web sites first, until the adsorption strength decreases drastically upon of entirety of the adsorption technique. Apply a Langmuir isotherm model for thermal symmetry adsorption on lead ion data and use the linear equation with the following formula:

$$q\_m = (q_m K_L C_e)/(1 + K_L\ C_e)$$

K_L: Langmuir constant representing the adsorption energy and binding in gm/ml. q_m: Maximum adsorption capacity in mg gm^{-1}.

The adsorption data was then applied to the Freundlich thermal symmetry equation. This equation is commonly used to describe the adsorption process in aqueous solutions and is as follows:

$$q_e = K_f C_e \frac{1}{n}$$

q_e: The amount adsorbed of ions per unit mass. K_f: Freundlich constant gm ml^{-1} representing the adsorption capacity of non-homogeneous surfaces $\frac{1}{n}$: Freundlich constant

Results and discussion

The consequences acquired from tables 3 and 4 indicated that the amount of adsorbed lead varied depending on the preliminary lead awareness, the quantity and form of introduced materials, and the traits of the observe soils. In preferred, the amount of adsorbed lead elevated with the boom inside the delivered lead amount, and the soil homes had a clean impact on figuring out the adsorbed quantity of lead on the floor in addition to the concentration of residual lead in the equilibrium answer. It became located that the variation in the amount of lead adsorbed by means of the soil was related to the chemical and bodily houses and the brought materials to these soils. The results highlighted the role of the initial concentration of the study soil samples in the efficiency of adsorption on the surfaces of added plant residues and animal residues. The adsorbed quantity improved with the increase within the delivered preliminary awareness for the have a look at soils and all brought materials, with the very best adsorbed fee (196.77) µg $gm^{-1}$of lead recorded for Kutayban soil with cow manure residues at an initial awareness of two hundred mg L^{-1}, even as the bottom adsorbed amount (16.90) µg gm-^{1} of lead changed into for Kutayban soil with the control remedy at a preliminary awareness of 20 mg L^{-1}. The adsorbed quantity of lead varied with special soils, brought materials, and preliminary concentrations, with the subsequent collection in growing adsorbed amount:

cow manure residues > wheat straw > control, with common values of ninety-eight.372, ninety-six.076, 89.752, and ninety-eight.48, 98.22, 88.11 for Al-Zubair and Kutayban soils, respectively.

Table 3.

The added and adsorbed quantities of lead and their percentage in the adsorption experiment for Al-Zubair soil

Coefficient	Con. Initial added Pb mg L^{-1}	Con. of adsorbed lead µg gm^{-1}	Per. Absorbed Pb (%)	Coefficient	Con. Initial added Pb mg L^{-1}	Con. of adsorbed lead µg gm^{-1}	Per. Absorbed Pb (%)
Comparative 0 ton ha^{-1}	20	18.22	91.1	Comparative 0 ton ha^{-1}	20	18.22	91.1
	40	25.95	64.87		40	25.95	64.87
	80	75.72	94.65		80	75.72	94.65
	160	140.20	87.62		160	140.20	87.62
	200	188.67	94.33		200	188.67	94.33
Average	100	89.752	86.514	Average	100	89.752	86.514
Wheat straw 20 tons ha^{-1}	20	19.64	98.20	Cow manure 40 tons ha^{-1}	20	19.35	96.79
	40	38.71	96.79		40	39	97.5
	80	77.43	96.79		80	78.38	97.98
	160	156.28	97.67		160	156.34	97.71
	200	187.32	93.66		200	196.25	98.12
Average	100	95.876	96.622	Average	100	97.864	97.62
Wheat straw 40 tons ha^{-1}	20	19.62	98.14	Cow manure 20 tons ha^{-1}	20	19.71	98.59
	40	39.03	97.59		40	39.52	98.81
	80	78.19	97.74		80	78.51	98.14
	160	154.79	96.74		160	157.39	98.37
	200	188.75	94.37		200	196.73	98.36
Average	100	96.076	96.916	Average	100	98.372	98.454

The exchange in the preliminary awareness of lead has an impact on the efficiency of adsorption, as a boom within the initial awareness of the detail creates an increase in the adsorption solution concentration, which in flip will increase the solution strain at the adsorption fabric and encourages ions to search for adsorption sites, whether or not superficial or in the pores of the adsorption cloth. This boom in adsorption on plant material surfaces might not reach the saturation factor of binding sites, as concentrations may not be enough to saturate all sites, meaning that the adsorption sites exceed the solution's capacity to fill active web sites effectively [23]. Previous studies have indicated that a lower in the share of adsorption with a growth within the initial awareness does not always mean a lower inside the adsorbed amount. Instead, there is an increase inside the adsorbed quantity with a growth in the preliminary awareness, but this increase in adsorption does now not immediately correlate with the increase in the preliminary awareness. Doubling the preliminary attention does now not necessarily double the adsorption quantity; it can be much less than double, explaining the decrease in the percentage of adsorption [24].

Table 4.

The added and adsorbed quantities of Pb and their percentage in the adsorption experiment for Kutayban soil

Coefficient	Con. Initial added Pb mg L^{-1}	Con. of adsorbed Pb µg gm^{-1}	Per. Absorbed Pb (%)	Coefficient	Con.Initial added Pb mg L^{-1}	Con. of adsorbed Pb µg gm^{-1}	Per. Absorbed Pb (%)
Comparative 0 ton ha^{-1}	20	16.90	84.5	Comparative 0 ton ha^{-1}	20	16.90	84.5
	40	30.45	76.12		40	30.45	76.12
	80	70.65	88.31		80	70.65	88.31
	160	132.44	82.77		160	132.44	82.77
	200	190.11	95.05		200	190.11	95.05
Average	100	88.11	85.35	Average	100	88.11	85.35
Wheat straw 20 tons ha^{-1}	20	19.58	97.9	Cow manure 40 tons ha^{-1}	20	19.59	97.99
	40	39.48	98.71		40	39.54	98.85
	80	78.40	98.00		80	78.77	98.47
	160	157.20	98.25		160	157.74	98.58
	200	196.44	98.22		200	196.76	98.38
Average	100	98.22	98.216	Average	100	98.48	98.454
Wheat straw 40 tons ha^{-1}	20	19.63	98.19	Cow manure 20 tons ha^{-1}	20	19.561	97.80
	40	39.52	98.80		40	39.46	98.66
	80	77.42	96.77		80	78.40	98.00
	160	156.31	97.69		160	132.25	98.28
	200	195.51	97.75		200	196.77	98.38
Average	100	97.678	84.5	Average	100	98.288	98.224

After subjecting the facts to these equations, the consequences showed that everyone equations succeeded in describing the facts for the studied soil samples by means of calculating the coefficient of determination (R^2) as in keeping with table 5. However, the equations differed inside the linear system in providing the first-class description of the information thru the connection among the real and calculated adsorbed amounts. Therefore, the fulfillment of these equations for the studied soils in describing the adsorption reactions indicates that those elements are bound to adsorption sites on every surface, which might also include all adsorption techniques described by these equations however with varying proportions of these sites and bindings on every surface. This way that there may be a mixture of adsorption websites with one of a kind proportions that bind the element to the site. For example, as Langmuir assumes, there are precise and homogeneous adsorption sites in power with marginal interplay between the adsorbed molecules and the cloth web sites. Additionally, there is an adsorption surface characterized through having adsorption websites with various strength distributions with interactions among the adsorbed molecules and within the form of more than one layers as described by way of the Freundlich equation [25].

Table 5.

Coefficient of determination (R^2) values for the specific linear equations describing lead adsorption in the soil samples of the study

Cow manure			Wheat straw		
Linear Formulas					
Soil Type	**Equations**	**R^2**	**Soil Type**	**Equations**	**R^2**
Al-Al-Zubair	Langmuir I	0.882	Al-Al-Zubair	Langmuir I	0.861
	Langmuir II	0.997		Langmuir II	0.991
	Langmuir III	0.942		Langmuir III	0.963
	Langmuir IV	0.990		Langmuir IV	0.909
	Freundlich	0.999		Freundlich	0.914
Kutayban	Langmuir I	0.898	Kutayban	Langmuir I	0.992
	Langmuir II	0.903		Langmuir II	0.915
	Langmuir III	0.919		Langmuir III	0.924
	Langmuir IV	0.935		Langmuir IV	0.963
	Freundlich	0.931		Freundlich	0.971

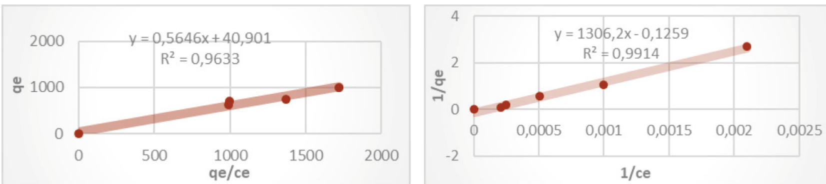
For the cause of comparing the take a look at of lead adsorption in a few soils of Basra Governorate (Al-Zubair and Kutayban), the maximum usually and comprehensively used equations for reading adsorption reactions, Freundlich and Langmuir, had been examined. These equations obtained excessive determination values (R^2) in describing the character of lead adsorption in the studied soils with the aid of calculating the constants of those equations, as proven in table 5. The Freundlich equation stood out, with all R^2 values being tremendously large for Al-Zubair soil at zero.999, while the Langmuir equation yielded the very best willpower coefficient of zero.997 for Kutayban soil. From this, it can be concluded that the 2 equations were quite near, with a mild superiority of the Freundlich equation in presenting an outline of the nature of lead adsorption.

The results showed (Fig.1, 2, 3(B), 4,5(A)) it's miles glaring that the Langmuir equation excelled in its linear shape in reaching the satisfactory description of the studied information for all equations regarding animal and plant residues used, except (Fig. 3(A)) for one coefficient from the full of all coefficients. This unique coefficient included the response of lead with cow manure residues in Al-Zubair soil, where the Freundlich equation outperformed in supplying the first-class description of the data by achieving the very best willpower coefficient of zero.999 compared to the other equations used for lead adsorption on the surfaces of brought materials. On the alternative hand, the Langmuir equation with the second one (Fig. 1(B)) assumption yielded a dedication coefficient of zero.997 for Al-Zubair soil. This equation (Langmuir) assumes that adsorption takes place in a unmarried layer with partial bonding, and adsorption handiest occurs at a consistent wide variety of unique sites which might be same and equivalent, without a lateral interaction and steric dilemma among the adsorbed molecules, even with adjacent web sites [26].

The Langmuir equation, in its assumptions, indicates that adsorption is homogeneous and that each molecule possesses capacity energies (enthalpies) and adsorptive activation energy (all web sites have equal affinities for adsorption) and not using a migration of the adsorption material on the surface stage. On the other hand, the Freundlich equation envisions adsorption in a couple of layers with irregular warmth and affinity distribution on a heterogeneous floor, not like Langmuir, which requires a homogeneous floor. The achievement of the thermal adsorption equations (Langmuir and Freundlich) in describing the studied statistics is due to the fact that adsorption between heavy factors and the natural residues under take a look at contained more than one styles of bonding due to the one of a kind nature of the web sites, material compositions, heavy elements, and as a result the version in affinities among the web sites and detail ions. This led to unique forms of bonds, which include layers of ion molecules, as defined by way of Langmuir, which accounted for the majority of the bonding, even as there were other bonds that included non-homogeneous and overlapping web sites in power and in a couple of layers, wherein the Freundlich equation succeeded According to the (Fig. 3(A), Fig. 5(B)).

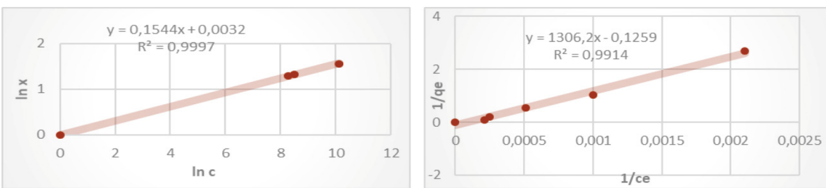
(A) (B)

Fig. 1. (A): The thermal adsorption of lead element in Al-Zubair soil according to the Langmuir (IV) equation on cow manure surfaces. (B): The thermal adsorption of lead element in Al-Zubair soil according to the Langmuir (II) equation on cow manure surfaces



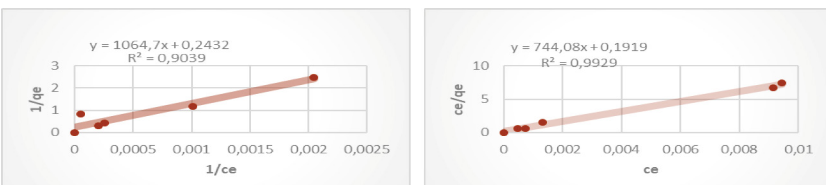
(A) (B)

Fig. 2. (A): The thermal adsorption of lead element in Al-Zubair soil according to the Langmuir (III) equation on wheat straw residue surfaces. (B): The thermal adsorption of lead element in Al-Zubair soil according to the Langmuir (II) equation on wheat straw residue surfaces



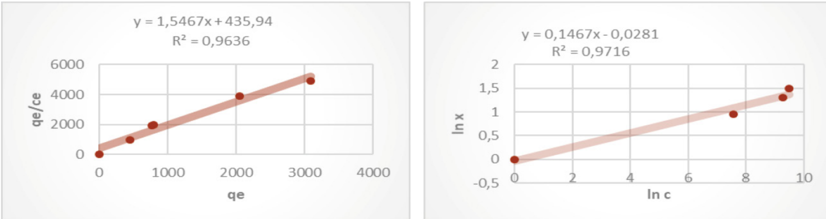
(A) (B)

Fig. 3. (A): The thermal adsorption of lead element in Al-Zubair soil according to the Freundlich equation on cow manure surfaces. (B): The thermal adsorption of lead element in Al-Zubair soil according to the Langmuir (II) equation on wheat straw residue surfaces



(A) (B)

Fig. 4. (A): The thermal adsorption of lead element in Kutayban soil according to the Langmuir (II) equation on cow manure residue surfaces. (B): The thermal adsorption of lead element in Kutayban soil according to the Langmuir (I) equation on wheat straw residue surfaces



(A) (B)

Fig 5. (A): The thermal adsorption of lead element in Kutayban soil according to the Langmuir (**IV**) equation on wheat straw residue surfaces. (B): The thermal adsorption of lead element in Kutayban soil according to the Freundlich equation on wheat straw residue surfaces.

The constants of the Freundlich equation, as shown in Table 6, 1/n and Kf, represent the adsorption density and capability in succession. Where 1/n measures the density of trade or surface heterogeneity. According to theory, adsorption situations are favorable if the Freundlich consistent is less than 1 [27]. Indicated that the adsorption technique for values < n 1 suggests favorable adsorption situations that in shape surfaces with excessive variability in properties, which means that this adsorption process is fine defined through the Freundlich equation. The consistent Kf represents the distribution consistent, or adsorption capability. The values of this regular ranged from the lowest adsorption restriction of 1.002 ml g^{-1} for the manage treatment to the best restriction of one 0.244 ml g^{-1} for cow manure residues for lead in Al-Zubair soil. In comparison, Kutayban soil had a lower adsorption capacity limit of 1.0055 ml g-1 for the manage treatment and a better adsorption restriction of one 0.61 ml g^{-1} for cow manure residues for lead. This demonstrates the excessive adsorption ability of cow manure residues in casting off lead from infected soils, and the adsorption floor's susceptibility varied with the form of delivered materials.

It is believed that the physical surface homes and chemical additives of the adsorption floor may play a position in influencing the nature of the relationship between the adsorption floor and the adsorption cloth. Additionally, it was mentioned Kilislioglu and Bilgin (2003) that the adsorbed amount depends on the equilibrium between the competitive adsorption of ions, ion length, the steadiness of the bond between the element ion and the adsorption fabric, the nature of the detail ions, the adsorption material response, and the distribution of active websites on the adsorption cloth [28]. Despite the similarities between the 2 equations in a few properties, the consistent inside the adsorption description method, as within the Langmuir equation, supports the outcomes obtained from making use of the Freundlich equation, which is based on heterogeneous floor residences.

To illustrate the effect of adding exceptional tiers of natural residues (wheat straw and cow manure) on lead adsorption, the Langmuir equation changed into utilized by plotting the connection between C/X values in opposition to C values and plotting the connection among Log X against Log C to attain the constants of the Freundlich equation, where Log K represents the intercept and the slope of the directly line represents b. It is evident that both equations provided a great description of lead adsorption thru the big willpower fee (R^2). When surveying the values of the constant n for the Freundlich model, which shows the intensity of adsorption, it changed into located that each one values of this regular are extra than one (1 > n), in line with table 5. This manner, consistent with the belief of adsorption cases, that this sort of interaction is favorable [29]. This may be attributed to the distribution of floor web sites or any aspect that reduces the interference of the adsorbate with the adsorption fabric while the surface depth will increase [30].

Table 6.

Constants of linear heat conduction symmetry models for lead adsorption on organic residues under study

Parameters	Coefficient	Equation	Soil type
K_f=1.0244 ml g^{-1} , n=0.1745	Comparative	Freun-dlich	
K_f=1.002 ml g^{-1} , n=0.155	Cow manure		
K_f=1.0086 ml g^{-1} , n=0.2449	Wheat straw		
qm =$(-0.2789)^{-1}$ µg g^{-1} , K_L=0.0001 ml $µg^{-1}$	Comparative	Langmuir I	
qm = $(0.0003)^{-1}$ µg g^{-1} , K_L =0.1875 ml $µg^{-1}$	Cow manure		
qm =$(-1.6593)^{-1}$ µg g^{-1} , K_L=0.0003 ml $µg^{-1}$	Wheat straw		
qm=$(1381.8)^{-1}$ µg g^{-1} , K_f=7003.547 ml $µg^{-1}$	Comparative	Langmuir II	
qm =$(122.92)^{-1}$ µg g^{-1} , K_f=9312.121 ml $µg^{-1}$	Cow manure		
qm =$(1306.2)^{-1}$ µg g^{-1} , K_f=10374.900 ml $µg^{-1}$	Wheat straw		
qm=-174.508 µg g^{-1} , K_F= -0.5062 ml $µg^{-1}$	Comparative	Langmuir III	
qm = -164.037 µg g^{-1} , K_f= -0.4619 ml $µg^{-1}$	Cow manure		Al-Zubair
qm = -72.442 µg g^{-1} , K_f= -0.5646 ml $µg^{-1}$	Wheat straw		
qm=-313.39 µg g^{-1} , K_f= $-(3.5567)^{-1}$ ml $µg^{-1}$	Comparative		
qm =263.52 µg g^{-1} , K_f=$(-1.5305)^{-1}$ ml $µg^{-1}$	Cow manure		
qm =33.87 µg g^{-1} , K_f=$(-2.2969)^{-1}$ ml $µg^{-1}$	Wheat straw	Langmuir IV	

K_f =1.0055 ml g^{-1} ,n=0.0911	Comparative	Freun-dlich	
K_f =1.061 ml g^{-1} , n=0.214	Cow manure		
K_f =1.0284 ml g^{-1} , n=0.1467	Wheat straw		
qm=$(0.0739)^{-1}$ μg g^{-1} ,K_L=0.0002 ml $μg^{-1}$	Comparative	Langmuir I	
qm =$(0.1889)^{-1}$ μg g^{-1} ,K_L=0.0005 ml $μg^{-1}$	Cow manure		
qm=$(0.1919)^{-1}$ μg g^{-1} ,K_L=0.0002 ml $μg^{-1}$	Wheat straw		
qm=$(1175.5)^{-1}$ μg g^{-1} , K_f=9779.534 ml $μg^{-1}$	Comparative	Langmuir II	
qm =$(1064.7)^{-1}$ μg g^{-1} , K_f=4377.878 ml $μg^{-1}$	Cow manure		
qm =$(1484.8)^{-1}$ μg g^{-1} , K_f=40021.563 ml $μg^{-1}$	Wheat straw		
qm= - 505.696 μg g^{-1} ,K_f= -0.941 ml $μg^{-1}$	Comparative		
qm = -430.852 μg g^{-1} , K_f= -0.4366 ml $μg^{-1}$	Cow manure		
qm = -742.769 μg g^{-1} , K_f= -0.3769 ml $μg^{-1}$	Wheat straw	Langmuir III	Ku-tayban
qm= 215.35 μg g^{-1} , K_f= $(-2.1796)^{-1}$ ml $μg^{-1}$	Comparative		
qm = -237.22 μg g^{-1} , K_f= $(-1.9506)^{-1}$ ml $μg^{-1}$	Cow manure		
qm =435.94 μg g^{-1} , K_f= $(-1.5467)^{-1}$ ml $μg^{-1}$	Wheat straw	Langmuir IV	

Conclusion

The additives to the study's soil samples of cow residues and wheat straw differed between them in giving values to the constants of adsorption equations (qm and k), where it is observed through the results high values of the binding power coefficient (k) For cow residues and wheat straw, maximum adsorption values decrease(qm) in sandy loam (zubair soils) compared with silty loam (kutayban soils). According to the Langmuir equation (I) , cow residues and wheat straw has a role in improving soil properties, as these equations successfully describe lead adsorption by soil samples and by using additives .It is noted from the results of the study that there is a large and important effect of the chemical and physical properties of the soil in determining the adsorption capacity of the soil, found that the value of the binding energy coefficient (K) of the Freundlich and Langmuir equations showed a positive correlation with the increase in the soil clay content. And calcium carbonate. It can be concluded that increasing the soil content of colloids (clay and silt) significant role in the adsorption of lead by the soil.

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AUTHOR CONTRIBUTIONS

Ayat Jasem Mohammed: was responsible for material preparation, data collection and writing the draft.

Salwa Jumaa Fakher: contributed to design the study, analyse the collected data, and write the manuscript. All authors read and approved the final manuscript.

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