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EFFECT OF SOIL AMENDMENTS ON ADSORPTION OF Zn IN LIGHT TEXTURE SOILS

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ABSTRACT

After treating soils by Slag, Shale and compost at the rate of 20 $mg.g^{-1}$ soil, on the adsorption of Zinc in sandy silt soil, sandy soil, silt clay loam soil and silt clay soil which were conducted under laboratory conditions. These soils had received different concentrations of Zn , there was an increase in the equilibrium concentration in this order as follows: Control > slag > shale > Compost. The maximum adsorption of Zn in different soils after treating with soil amendments conformed to both Freundlich isotherm in order: El Sadat City (sandy silt soil) > Milig Shibin Elkom (Silt clay loamy soil) > Malanta Slovakia R. (Silt loamy soil) > El Tahrier (Sandy soil), and Langmuir isotherm was formed as follow: Milig Shibin Elkom (Silt clay loamy soil) > El Sadat City (sandy silt soil) > Malanta Slovakia R. (Silt loamy soil) > El Tahrier (Sandy soil). The effect of soil treatments on the maximum adsorption means in spit of soil types can be arranged in the following order: Compost > shale > slag > control

Regression analysis between soil properties and adsorption maximum according to the Frendlich equation were weakly positive correlated as follow: Clay % (r=0.6616) > silt +clay % (r=0.6496) > C.E.C (r=0.5825) > pH (r=0.5374) > $Caco_3$ % (r=0.5284) > O.M % (r =0.4835) > silt (r = 0.4268) .

Also Langmuir equation in was positively correlated in the order: Clay % (r=0.8849) > silt + clay % (r=0.7291) > C.E.C (r= 0.7288) > pH (r = 0.6730) > silt % (r= 0.5367) > O.M (r= 5278) > $CaCo_3$ % (r= 0.2514) under different investigated soils.

Key words: Shale , Slag, compost, Zinc , adsorption value.

INTRODUCTION

Soil components are considered to be the most important group in contributing to competing for the Slag sorption mechanisms which can be based on the valiancy forces. Surface properties of soil particulates are the most important factor in defining the capacity for adsorption of micro nutrients supply to the plants. Some cation however may have a higher replacing power than others and can selectively fixed by the sorbing sites. Jurinak and Bver (1956) reported that , Zn was adsorbed on the crystal surfaces of the dolomite and magnesite in the lattice by replacing magnesium. Zn is also adsorbed less strangely on calcite than magnesite and dolomite.

Tiller and Hodgson (1962) found that silicate clays adsorbed zinc reversibly by cation exchange and irreversibly by lattice penetration. Abd-Elfattah and Wad (1981) stated the selectivity of adsorption reveals a possible formation of the coordination complex of the heavy metals with deprotonated OH and COOH groups as legends. The adsorption capacity of Zn significantly correlated with the levels of CaCO3 , organic carbon and CEC of soils. Prasad and Kusum (1991) in their study found that the maximum adsorption of Zn decreased as follows : Loamy > sandy loamy > sandy soil. Bunzle *et al* .(1976), Singh and Sekhon (1977) found that adsorption of one divalent ion of metals ,Pb , Zn or Cu by peat was accompanied with releasing of the two ion hydrogen. Raddy and Perkins (1974) , Radwan (1992) and Rahma *et al* . (1993) found that the clay, organic matter, cation exchange capacity and soil reaction (pH) also influenced on the amount of Zn by soils . The maximum adsorption values of Zn were increased with increasing clay content % of soils, pH , OM and $CaCO_3$ %. Abou Hussien (1995) found that Zn adsorption was increased with increasing Zn concentration. The intensity of Zn adsorption was increased with increasing fineness of soil texture, there is no significant simple correlation between maximum adsorption , organic matter and $CaCO_3$. Shalabey and Bizik (1997) after treating soils with FYM at rate 20 tone.h^{-1} and sodium humate at the rate of 5 kg.h^{-1} at different concentrations of Zn. The amount of Zn adsorbed and maximum adsorption were decreased as follows: FYM with soil > Sodium humate with soil > Control soil. Maximum adsorption of loamy soil was higher than sandy soil. The aim of this study was to define the effect of the added soil amendments on the adsorption as well as on the maximum adsorption of Zn in different studied soils.

MATERIAL AND METHODS

Four soil samples were taken from the surface layer (0-20 cm) of the fields in the locations, El-Sadat City, El-Tahrer region, Milig Valage, and Malanta from Slovak Republic. Samples were sieved through a 0.2 mm screen and stored in plastic page , shale, slag and compost were crushed and sieved through 0.16 mm screen and also stored in plastic page. Samples were analyzed for some physical and chemical properties. Table 1. Mechanical analysis, by Pipet method described by Piper (1950). pH after extracting in solution 1 M KCL, organic matter according to method Walkely-Black, CEC in ammonium acetate solution, $CaCO_3$ by means of the volumetric method. All methods were described by Cottenie *et al.* (1982) . Zn was determined by atomic absorption spectrophotometer . All chemical analysis and experiments were measured at the laboratory temperature (25 ^{o}C).

Adsorption studies

Different concentrations of Zn 50,100,200,300,and 400 ppm prepared by dissolving $ZnSO_4.7H2O$ in 0.01M $CaCl_2$ solution. These solutions were added to the soil (1:10 soils to solution). The amount of adsorption materials were used 5 gm of soil alone or with 0.1 gm of Shale, Slag and compost. All were put in series of polythene centrifuge tubes were vigorously shaken for two hours . The supernatant solutions were separated by centrifuge at 2000 r.p.m for five minutes, and the residual content of Zn in clear solution was determined by using atomic absorption.

Table (1): Some physical and chemical characteristics of soil used in experiments.

Location of soils	pH	EC, $mS.Cm^{-1}$	OM %	$CaCo_3$ %	CEC, $mmol.Kg^{-1}$	Zn, ppm	Sand %	Silt %	Clay %	Texture Grade
El –Sadat city	7.94	1.82	0.3648	5.00	139.22	6.25	72.76	19.35	7.89	Sand silt
El Tahrier	7.35	0.41	0.0102	0.80	48.82	1.49	96.95	1.90	1.15	Sandy
Milig, Shibin Elkom	7.97	0.31	2.7416	1.80	459.00	23.28	14.25	55.05	30.70	Silt clay loamy
Malanta Slovakia R.	7.05	0.18	3.4986	0.40	410.00	16.62	15.81	65.21	18.98	Silt clay

Table (2): Some chemical characteristics of materials are used.

Materials	pH	EC, $mS.Cm^{-1}$	CEC, $mmol.Kg^{-1}$	Zn, ppm
Shale	8.54	7.15	433.4	75.50
Slag	10.39	0.78	42.08	15.10
Compost	8.08	6.29	455.20	105.70

The amount of absorbed element (x/m) in mg/gm soil were calculated as the difference between the initial concentration and the remain concentration in the solution (C ppm) . The amount of Zn adsorbed from different Zn levels in solutions of the investigated soil samples can be described by using Freundlich equation. This equation was given below which was employed to interpret the reaction of Zn with different treatments.

$Q=KaC^{1/n}$

The logarithmic equation of Freundlich was described as :

Log Q= Log Ka +1/n Log C

Where, log Q = the adsorption maximum (x/m).

Log Ka = intercept (distribution confections).

1/n = slope (correction factors), Log C equilibrium

The correlation coefficient, between Log C and Log (x/m) were calculated by means of regression analysis . The slope and intercept of lines were used for the calculation of maximum adsorption by fixed the concentration of control in different soils and treatments.

Langmuir equation was also used to compare with Freundlich one and in the end decide the best one to apply in our condition. Langmuir equation described as the following:

C/Q = a + bC

Where

C = the equilibrium concentrations of Zn .

Q = the amount of Zn adsorbed mg/g soil.

a = the intercept of line.

b = the slope of the line.

From this equation we can calculated the following parameters, adsorption maximum = 1/ slope = 1/b (mg/g soil) .

Bending energy = slope / intercept (L/mg)

RESULTS AND DISCUTION

Data in Table 3. Illustrate the effect of Zn at different concentration on equilibriums concentration (C) and the amount of Zn adsorbed element (x/m) in different soil after activated with (slag, shale, and compost) .

Table (3): Effect of different zinc concentration after treated soils with Slag, Shale and compost on the equilibrium concentration (C, ppm), amount of zinc adsorbed (x/m, mg/g).

Sandy silt soil (El sadat City) Treatments		Concentration of Zn ppm 50	100	200	300	400	Means x/m mg/g
Control	C	0.19	0.384	1.964	9.64	23.78	
	x/m	0.4981	0.99616	1.98036	2.9036	3.7622	2.028
Slag	C	0.176	0.268	1.896	9.438	22.84	
	x/m	0.49824	0.99732	1.98131	2.9056	3.7716	2.031
Shale	C	0.104	0.238	1.002	8.416	21.44	
	x/m	0.49896	0.99762	1.9899	2.9158	3.7856	2.038
Compost	C	0.09	0.214	1.044	8.09	19.94	
	x/m	0.4991	0.99786	1.98956	2.9191	3.8006	2.041
Means x/m							2.034
Sandy soil (El Tahrier)							
Control	C	1.346	9.556	55.48	89.21	134	
	x/m	0.48654	0.90444	1.4452	2.1079	2.66	1.521
Slag	C	1.26	9.208	44.4	89.2	128.8	
	x/m	0.4874	0.90792	1.556	2.108	2.712	1.554
Shale	C	0.288	7.828	37.14	77.9	110.8	
	x/m	0.49712	0.92172	1.6286	2.221	2.892	1.632
Compost	C	1.13	7.12	23.48	70.38	96.0	
	x/m	0.4887	0.9288	1.7652	2.2962	3.04	1.704
Means x/m							1.603
Silt clay loamy soil (Milig Shibin Elkom)							
Control	C	0.188	0.375	0.974	2.92	3.53	
	x/m	0.49812	0.99625	1.99026	2.9270	3.3964	1.962
Slag	C	0.068	0.348	0.612	2.42	3.394	
	x/m	0.49932	0.99652	1.99388	2.9758	3.9660	2.086
Shale	C	0.044	0.244	0.488	1.512	3.312	
	x/m	0.49956	0.99756	1.99512	2.9848	3.9668	2.089
Compost	C	0.102	0.21	0.472	1.42	2.92	
	x/m	0.49898	0.9979	1.99528	2.9858	3.9708	2.090
Means x/m							2.057
Silt clay soil (Malanta Slovakia Rep.)							
Control	C	0.302	1.586	14.44	29.46	59.58	
	x/m	0.49698	0.98414	1.8556	2.7054	3.4042	1.889
Slag	C	0.244	1.102	13.36	27.1	55.84	
	x/m	0.49756	0.98898	1.8664	2.729	3.4416	1.905
Shale	C	0.184	1.046	6.262	23.52	39.84	
	x/m	0.49816	0.98954	1.93738	2.7648	3.6016	1.958
Compost	C	0.22	1.00	3.816	16.76	36.05	
	x/m	0.4978	0.99	1.96184	2.8324	3.6395	1.984
Means x/m							1.934

Highly significant correlation was obtained between (C) and (x/m). The results show that the equilibrium concentration (C) was increased by increasing initial concentration. The adsorbed quantities of Zn (x/m = mg/g soil) were increased by increasing equilibrium concentration in all treatments i.e control, slag, shale and compost also with all soils. Relating to the effect of different soil treatments the values of x/m are shown that they can arrange in the following order: Compost > shale > slag > control. In spit of the effect of both Zn concentrations and soil types the adsorbed Zn amount (mg/g) were: 1.955, 1.929, 1.894 and 1.850 for treated with compost, shale, slag and control respectively. Regardless the effect of both Zn concentration and soil treatments the obtained mean values for adsorbed Zn were : 2.034, 1.603, 2.057, and 1.934 mg Zn /g soil for El Sadat City (sandy silt soil), El Tahrier (sandy soil), Milig Shibin Elkom (silt clay loamy soil) and Malanta Slovakia R. (silt clay soil). These means that the effect of soils can be arrange in the following order: Milig Shibin Elkom (silt clay loam) > El Sadat City (sandy silt) > Malanta Slovakia R. (silt loam) > El Tahrier (sandy soil).

Highly significant correlated was obtained between (C) and (x/m) according to the Freundlich isotherm in Table 4&5 and Fig. 1. The maximum adsorption was formed in El sadat City (sand silt soil) with values 4.2128, 4.2014, 4.3965, 4.4763 mg/g. In El Tahrier (sandy soil) 2.3523, 2.4944, 2.5611, 3.2710 mg/g. In Milig Shibin Elkom (silt clay loamy soil) 3.5947, 3.9683, 4.4006, 5.1278 mg/g and Malanta Slovakia R. (silt loamy soil) 3.3581, 3.4574, 4.1161, 4.7819 mg/g for control, slag, shale and compost respectively. The maximum adsorption of different soils after treatments with the slag, shale and compost were increased approximately in order : 4.46 % for slag , 14.47 % for shale and 30.62 % for compost compared with control. The highest value of the maximum adsorption for different soil were formed as follow: El Sadat City (sandy silt soil) 4.3217 mg/g > Milig Shibin Elkom (silt clay loamy soil) 4.2728 mg/g > Malanta Slovakia R. (silt loamy soil)3.9284 mg/g > El Tahrier(sandy soil) 2.6697 mg/g.

Table (4):Freundlich and Langmuir isotherms for different treatments and its applied on maximum adsorption in different soils.

Locations	Treatme.	Freundlich Equation			Langmuir Equation			
		Y=	R^2	Ad.Mam g/gm	Y=	R^2	Ad.Mamg/gm	K, B.E L/mg
El-Sadat City	Control	$1.2242\ X^{0.3900}$	0.9441	4.2128	0.2538 X + 0.4547	0.9906	3.9401	0.5581
	Slag	$1.2909\ X^{0.3724}$	0.9293	4.2014	0.2550 X + 0.4109	0.9888	3.9215	0.6205
	Shale	$1.4530\ X^{0.3494}$	0.9243	4.3965	0.2583 X + 0.2883	0.9898	3.8714	0.8959
	Compost	$1.4883\ X^{0.3475}$	0.9368	4.4763	0.2577 X + 0.2735	0.9885	3.8804	0.9422
El Tahrier	Control	$0.4187\ X^{0.3524}$	0.9730	2.3523	0.3570 X + 8.2060	0.8965	2.8011	0.0435
	Slag	$0.4284\ X^{0.3597}$	0.9895	2.4944	0.3502 X + 7.0998	0.9366	2.8555	0.0493
	Shale	$0.6348\ X^{0.2848}$	0.9521	2.5611	0.3355 X + 5.3536	0.9260	2.9806	0.0627
	Compost	$0.4542\ X^{0.4031}$	0.9879	3.2710	0.3135 X + 4.6813	0.9510	3.1897	0.0670
Milig, Shibin El Kom	Control	$1.6481\ X^{0.6183}$	0.9648	3.5947	0.2171 X + 0.3092	0.9861	4.6061	0.7021
	Slag	$2.0458\ X^{0.5253}$	0.9684	3.9683	0.2141 X + 0.1992	0.9367	4.6707	1.0748
	Shale	$2.3514\ X^{0.4969}$	0.9761	4.4006	0.2149 X + 0.1431	0.9755	4.6533	1.5017
	Compost	$2.3995\ X^{0.6021}$	0.9529	5.1278	0.1959 X + 0.1718	0.9923	5.1046	1.1402
Malanta from Slovakia R.	Control	$0.7818\ X^{0.3566}$	0.9943	3.3581	0.2780 X + 1.8191	0.9615	3.5971	0.1528
	Slag	$0.8544\ X^{0.3420}$	0.9885	3.4574	0.2777 X + 1.5607	0.9599	3.6101	0.1779
	Shale	$0.9462\ X^{0.3597}$	0.9964	4.1161	0.2710 X + 1.0055	0.9705	3.6900	0.2699
	Compost	$0.9756\ X^{0.3889}$	0.9826	4.7819	0.2616 X + 0.8179	0.9870	3.8226	0.3198

Ad.Ma = Adsorption maximum. K_a B.E = Constant of binding energy.

The Langmuir adsorption parameters, adsorption maxima and bonding energy constant were calculated and are given in Table 4&5 and Fig.2. data revealed that high significant correlation for plotting C/x/m versus C for all investigated treatments . The maximum adsorption gave mean values to 3.9401, 2.9567, 4.7586 and 3.6798 mg/g, for El Sadat City (sandy silt soil) ,El Tahrier (sandy soil), Milig Shibin Elkom (silt clay loam soil) and Malanta Slovakia R. (silt clay soil). The maximum adsorption was arranged in different soil in order :

Table (5): Effect of soil types and soil amendments on maximum adsorption (mg/g) according to the Freundlich and Langmuir.

Treatments	Freundlich				Means
	Control	Slag	Shale	Compost	
Sandy silt soil	4.2128	4.2014	4.3965	4.4763	4.3217
Sandy soil	2.3523	2.4944	2.5611	3.2710	2.6697
Silt clay loamy soil.	3.5947	3.9683	4.4006	5.1278	4.2728
Silt clay soil	3.3581	3.4574	4.1161	4.7819	3.9284
Means	3.3795	3.3504	3.8686	4.4142	
	Langmuir				
Sandy silt soil	3.9401	3.9216	3.8714	3.8805	3.9034
Sandy soil	2.8011	2.8555	2.9806	3.1898	2.9567
Silt clay loamy soil.	4.6061	4.6707	4.6533	5.1046	4.7587
Silt clay soil	3.5971	3.6101	3.6900	3.8221	3.6798
Means	3.7361	3.7644	3.7988	3.9992	

Milig Shibin Elkom (silt clay loam soil) > El Sadat City (sandy silt soil) > Malanta Slovakia R. (silt clay soil) > El Tahrier (sandy soil).

The effect of soil treatments on the maximum adsorption means in spit of soil types can be arranged in the following order: Compost 3.9992 mg/g > shale 3.7988 mg/g > slag 3.7644 mg/g > control 3.73612 mg/ g.

For bonding energy K_a in different soils table (4) were increased compared with control in order : Milig Shibin Elkom (silt clay loamy soil) 1.1046 L/mg > El Sadat City (sandy silt soil) 0.7542 L/mg > Malanta Slovakia R. (silt clay soil) 0.2301 L/mg > El Tahrier (sandy soil) 0.0556 L/mg. Generally the bonding energy was increased by treated soil with amendments as follow: Control < slag < shale < compost, except Milig Shibin Elkom (silt clay loamy soil) in order: Control < slag < compost < shale.

The Langmuir adsorption parameters, adsorption maxima and bonding energy constant in different investigated soils were increased as follow: Milig Shibin Elkom (silt clay loamy soil) > El Sadat City (sandy silt soil) > Malanta Slovakia R. (silt clay soil) > El Tahrier (sandy soil).

The difference in adsorption maximum means for soils were related to % clay, %OM, pH and CEC. These observation agree with results obtained by Bunzl *et al.* (1976) which studied the rates of adsorption and desorption of Zn by soil organic matter. He showed that the adsorption of one divalent metal ion by peat was coupled with the release of two hydrogen ions. In this instance Ezz El-Din (1978), Rahma (1993) found that the higher rate of the increasing Zn adsorbed is corresponding to the increase of concentration 20 to 2000 ppm. Acieration concentration of Zn was increased by increasing cat ion exchange capacity and also with soil having fine texture.

Regression analysis between soil properties and adsorption maximum table (6) according to Frendlich equation were weakly positive correlated as follow: Clay % (r=0.6616) > silt +clay % (r=0.6496) > C.E.C (r=0.5825) > pH (r=0.5374) > $Caco_3$ % (r=0.5284) > O.M % (r =0.4835) > silt (r = 0.4268) .

Also in Table 6. Langmuir equation in was positively correlated in the order: Clay % (r=0.8849) > silt + clay % (r=0.7291) C.E.C (r= 0.7288) > pH (r = 0.6730) > silt % (r= 0.5367) > O.M (r= 5278) > $CaCo_3$ % (r= 0.2514) under different investigated soils. These results agree with the results obtained by Prasad and Sarangthem (1993) which noted that adsorption maximum significantly correlated with levels of $CaCO_3$, organic carbon and CEC of soils.

Table (6): Regression analysis between soil properties and maximum adsorption.

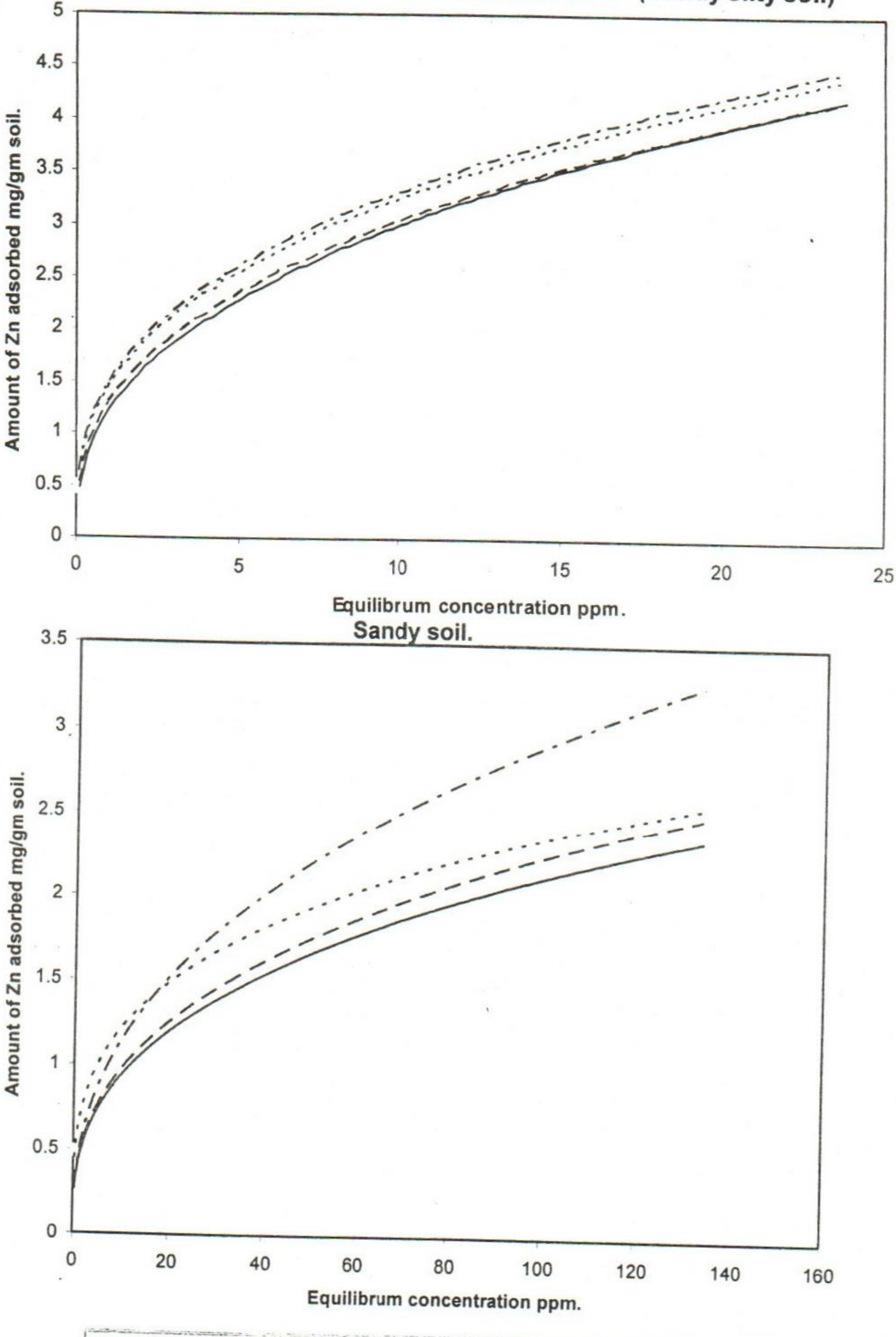
Soil properties	Frendlich equation	r	Langmuir Equation	r
Clay %	-82.5489 + 34.9134X	0.6496	-105.889 + 40.7740 X	0.7291
Silt %	-27.502 + 11.1059 X	0.6616	-44.4363 + 15.4567 X	0.8849
Silt + Clay %	-40.0516 + 18.7132X	0.4268	-62.6323 + 24.4874 X	0.5367
C.E.C $mmol.Kg^{-1}$	-277.771+144.4865X	0.5824	-444.069+187.7548X	0.7288
Ca CO_3 %	6.3803 + 0.3151 X	0.5374	6.0120 + 0.4098 X	0.6730
O.M %	-4.4242 + 1.7572 X	0.5284	1.06557+0.86809X	0.2513
pH	-2.4508 + 1.0808 X	0.4835	-3.02589+1.2253X	0.5278

Kuo and Mikkelsen (1979) found that the maximum adsorption positively correlated with clay or (clay + silt) percent content of soils. Leeper (1952) postulated that calcium carbonate was strong adsorbent for heavy metals. Radwan (1992) and Abou Hussin (1995) represented that Adsorption maximum of different soils was increase by increasing fineness of soil texture. Significant correlation between increase (silt + clay) % and adsorption maximum, and also insignificant correlation between $CaCo_3$, organic matter and maximum adsorption .

The results leads to the conclusion that the adsorption of Zn in different soils after treating with soil amendments conformed to both Freundlich isotherm in order: El Sadat City (sandy silt soil)) > Milig Shibin Elkom (silt clay loamy soil) > Malanta Slovakia R. (silt loamy soil) > El Tahrier (sandy soil), and Langmuir isotherm was formed as follow: Milig Shibin Elkom (silt clay loamy soil) > El Sadat City (sandy silt soil) > Malanta Slovakia R. (silt loamy soil) > El Tahrier (sandy soil). For soil amendments were formed as follow: compost > slag > shale > control.

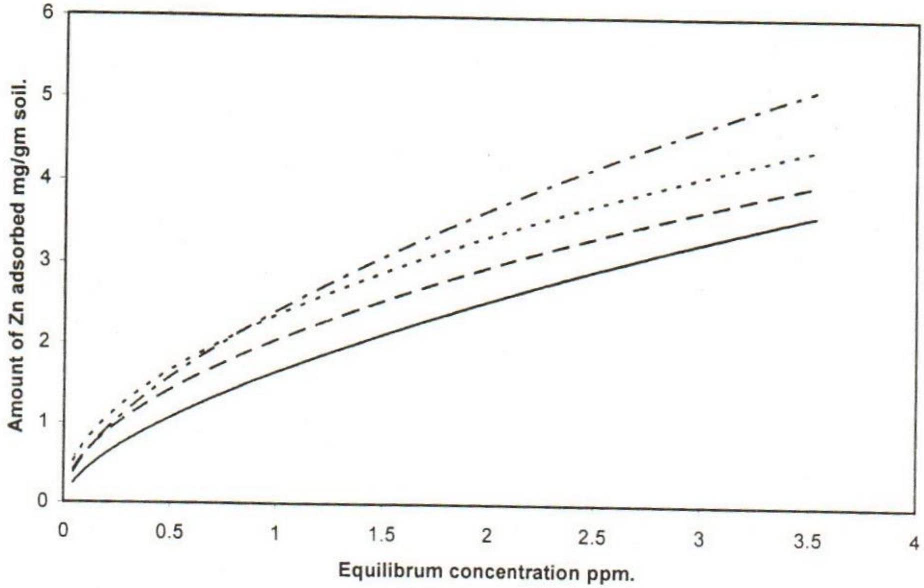
Langmuir equation is the best model for applying in soils under investigation than Freundlich equation.

Fig.1. Freundlich isotherm for Zn in different soils. (Sandy silty soil)

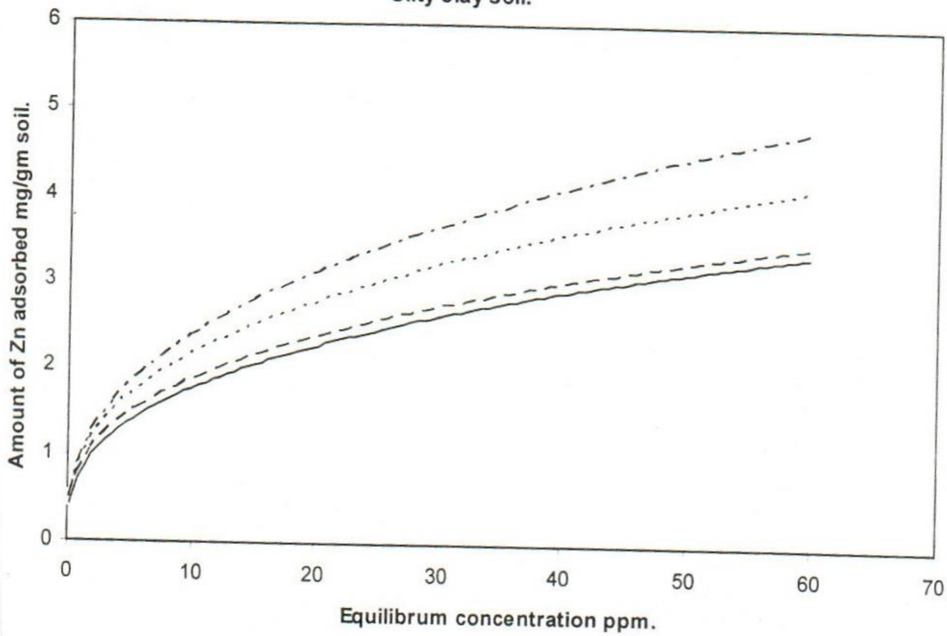


Continued.

Silt clay loamy soil.



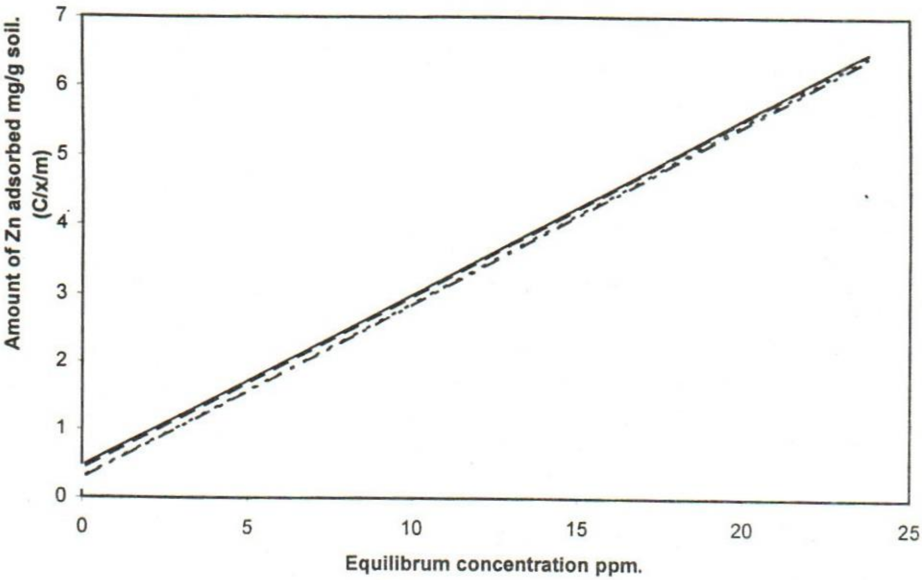
Silty clay soil.



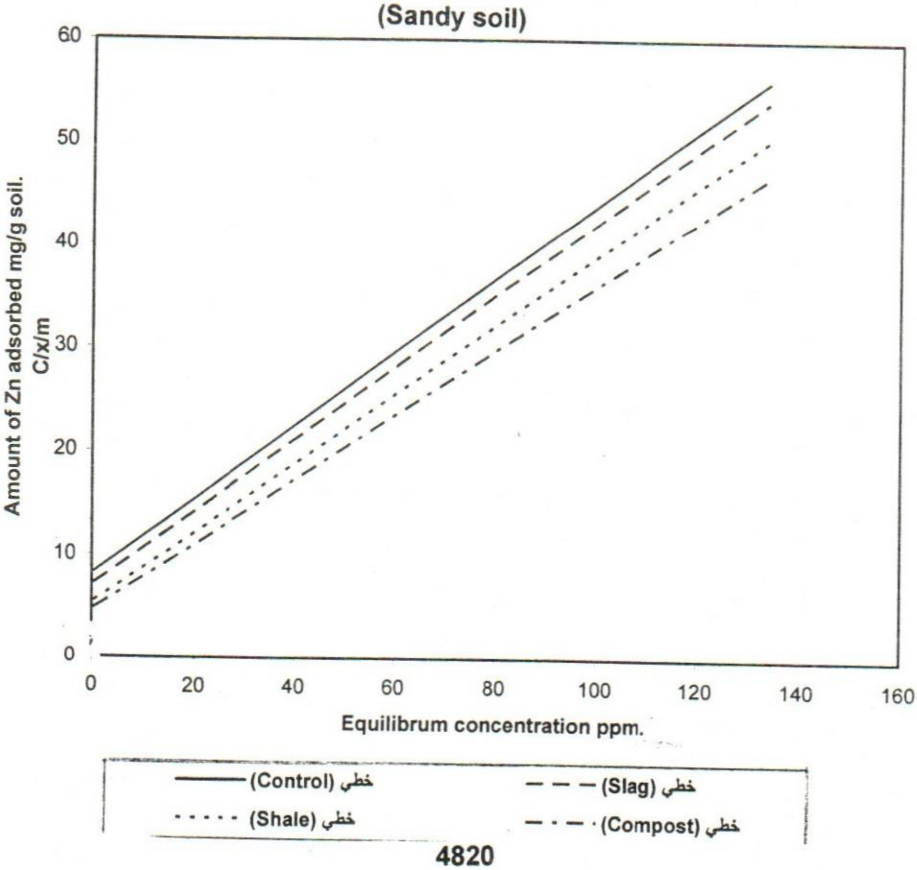
——— (Control) قوة – – – – (Slag) قوة · · · · · · (Shale) قوة – · – · – · (Compost) قوة

Fig.2. Langmuir isotherm for Zn in different soils.

(Sandy silty soil)



(Sandy soil)



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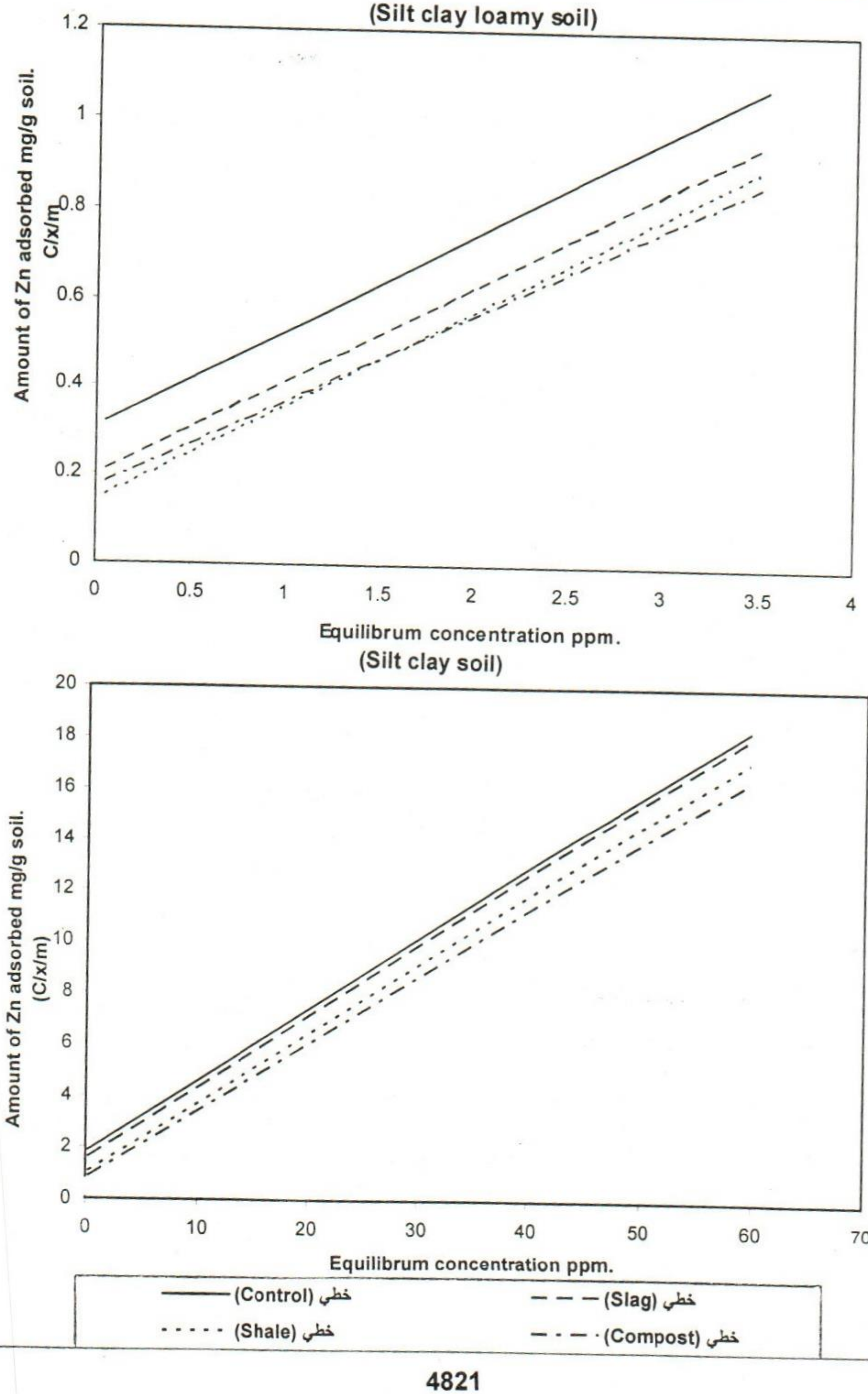
(Silt clay loamy soil)
Amount of Zn adsorbed mg/g soil. C/x/m
1.2
1
0.8
0.6
0.4
0.2
0
0
0.5
1
1.5
2
2.5
3
3.5
4
Equilibrum concentration ppm.
(Silt clay soil)
Amount of Zn adsorbed mg/g soil. (C/x/m)
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
Equilibrum concentration ppm.
(Control) خطي
(Slag) خطي
(Shale) خطي
(Compost) خطي

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تأثير الإضافات الأرضية على امتصاص الزنك في الأراضي الخفيفة القوام

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في تجربة معملية تم معامله الأرض بالإضافات الأرضية مثل خبث المعادن ، الطفلة ، الكومبوست بمعدل ٢٠مجم/ جم على أدمصاص الزنك في أراضي رملية سلتيه ، رملية ، طينيـة طميـه سلتية وأراضي سلتيه طينية مع إضافة الزنك لهذه الأرض بمستويات مختلفة ووجد أن الزنـك فـي محلـول الاتزان قد ازداد بزيادة تركيز الزنك بمعدلاته المختلفة وأن هذه الزيادة تتبع الترتيب الأتي:
الكنترول > خبث المعادن + الأرض > الأرض + الطفلة > الأرض + الكومبوست. كما وجـد أن كميـة الزنك المد مصة والسعة الإدمصاصية للزنك قد زادت تبعا لمعادله فروندلج على النحو التالي :
أرض رمليه سلتيه (مدينة السادات) > أرض سلتيه طينيه طميه (مليج شبين الكوم) > أرض سـلتيه طينيـه (مالا نطا سلوفاكيا) > أرض رمليه (التحرير).
بالنسبة لمعادله لانجمير :أرض سلتيه طينيه طميه (مليج شبين الكـوم) > أرض رمليـه سـلتيه (مدينة السادات) > أرض سلتيه طينيه (مالا نطا سلوفاكيا) > أرض رمليه (التحرير).
كما وجد أن أعلى قيمة للسعة الإدمصاصية للزنـك لمحسـنات التربـة تتبـع الترتيـب الأتـي: الأرض + الكومبوست > الأرض + الطفله > الأرض + خبث المعادن > كنترول.
أما معامل الارتباط فله علاقة إيجابية ضعيفة بين السعة الإدمصاصية و كل من النسبة المئويـة للطين (٠,٦٦١٦) ،النسبة المئوية للسلت + الطين (٠,٦٤٩٦)،السعة التبادلية الكاتيونية (٠,٥٨٢٥) ،وقيمة الـpH (٠,٥٣٧٤)، النسبة المئوية لكربونات الكالسيوم (٠,٥٢٨٤) النسبة المئوية للمادة العضـوية(٠,٤٨٣٥) و النسبة المئوية للسلت (٠,٤٢٦٨) تبعا لمعادله فروندلج.
بالنسبة لمعادله لانجمير ، فمعامل الارتباط له علاقة إيجابية قويه تقـل تـدريجيا بـين السـعة الإدمصاصية وخواص التربة كالأتي: النسبة المئوية للطين (٠,٨٨٤٩) > النسبة المئوية للسلت + الطـين (٠,٧٢٩١) السعة التبادلية الكاتيونية (٠,٧٢٨٨) > وقيمة الـ pH (٠,٦٧٣٠) > و النسـبة المئويـة للسلت (٠,٥٣٦٧) النسبة المئوية للمادة العضوية (٠,٥٢٧٨) > النسبة المئوية لكربونـات الكالسـيوم (٠,٢٥١٣).