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The Specific Adsorption of Copper and Zinc in the North East Nile Delta Soils

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ABSTRACT

This study deals with the effect of soil properties on the specific adsorption of copper and zinc in the soils north eastern Nile Delta., so that seven soil profiles were taken. Then a detailed study was conducted to include physical and chemical properties of the soil samples as well as a quantitative specific adsorption of copper and zinc experiments were carried out. Percentage of soil organic matter ranged from 0.2% to 3.6%. Soil texture varies from silt to heavy clay. Percentage of calcium carbonate ranged from 1.3 to7.5 %. Soil pH values ranged from 7.5 to 9.7. Soil salinity varied from non-saline to saline, with salinity ranging from 1.4 to 32.7 dS.m^{-1}. CEC values ranged from 10.8 to 52.5 cmokg^{-1} soil. The specific adsorption of copper and zinc ions in presence of sodium as a monovalent cation was higher than that of calcium as a divalent cation. It was also found that the higher the concentration of the added ions, the higher the specific adsorption for Cu^{2+} and Zn^{2+}, which can be represeted by a straight line equation. The specific adsorption of copper and zinc in the surface soil samples was higher than that in the subsurface soil samples due to the roll of the soil organic matter.

Keywords: The Specific Adsorption; Copper; Zinc

INTRODUCTION

Heavy metals are the group of chemical elements that have densities greater than five (>5 g cm^3), as well as a large atomic number. They are naturally present in the soil as a result of rock weathering, and may also be added to the soil by human or natural factors. Among the causes of soil contamination are:

1- Transmission of polluting materials with torrential water or groundwater.
2- Transmission of pollutants from the places where they are collected (for example, landfills) to the surrounding environment.
3- Pollution by sedimentary substances from the atmospheric air in industrial areas.
4- Excessive use of fertilizers, pesticides and chemicals.
5- Storage and transportation of raw materials and harmful waste.

The contaminating products are integrated into the complex soil and distributed amongst the different phases present, namely the solid phase, the soluble and insoluble organic-mineral complexes. And it may be found as exchangeable forms, as well as free ions in soil solution.

When a contaminating substance is present in the soil, its effect is directly related to its reactivity, rather than to its total amount or concentration.

The physical and chemical properties of a soil play a great role in governing the relationship between reactivity and total content of the contaminating substance. However, its action is specifically linked to the nature of the pollutant, which may be, more or less, toxic Appenroth (2010).

The specific Adsorption of heavy metal ion are defined by as the amount of adsorbed heavy metal ions in presence of different amounts of some ions large enough to prevent adsorption on normal exchange sites, as stated by Mc Laren and Crawford (1973).

The general values for the average total copper (Cu) contents in soils of different types all over the world are reported to range between 20 and 30 mg /kg (Alloway 1995). Copper as well as zinc are essential elements to both plants and animals. In plants, Cu is especially important in oxidation, photosynthesis, and protein and carbohydrate metabolism. James and Barrow (1981) believed that liming a soil stimulates mineralization of organic matter and this may release copper. Zinc is also one of the essential micronutrients for plants. It has some similarities with iron and magnesium competing in plant uptake with these elements. Furthermore, high levels of phosphate in soils reduce zinc availability (Neue *et.al*, 1998).

Mellouk *et.al*, (2011) stated that the insertion of Na$^+$ into halloysite could affect Cu adsorption. They added that the magnitude in enhancement copper adsorption on solid phase depends on the content of the carboxylic functional groups, which increases with the insertion of COO$^-$ into the halloysie matrix. The involved mechanism may be quite complex. It implies electrostatic considerations and a cationic exchange process. Other effects of buffer pre-treatment are an additional release of soluble organic acids and a cation exchange where H+ in carboxylic and hydroxyl groups is substituted by Na+. Kalmykova, et al. (2008) indicated that due to the increase in pH-value as a result of buffer treatment, the peat macro molecules would become more negatively charged, so that the organic molecules will repel each other and the structures will be more uncurled, resulting in a greater number of active sites for adsorption of metal-ions. On the other hand, the carbonate fraction could be extracted by mild acidic solutions. Applications of sequential extraction methods were summarized by Filgueiras et al. (2002) to characterize pollution sources, evaluation of metal mobility and bioavailability, and identification of binding sites of metals for assessing metal accumulation, pollution and transport mechanisms. Although sequential extractions are

time consuming, these methods provide imperative knowledge about element mobility and availability in soil. The measurement of total concentration of metals in soils is useful to detect any net change due to different possible phenomena. Dahlin et al.,(2002) indicated that sequential extraction procedures cannot be used as stand-alone evaluations to identify the actual form of metals in soils and should be accompanied by deeper experimental investigations. There is a distinct relationship, of ion and metal ion, in the presence of Ca^{+2} from any salt where adsorption of many heavy metals was much reduced , so that Ca^{+2} compete with the metals on the exchange sites. This fact was indicated by many investigators, Cavallaro and McBride (1978), McBride (1980), Christensen (1984) and Mehta et. al (1984). Raikhy and Takkar (1983) concluded that adsorption of zinc by soil was signifantly proportional to calcium carbonate content. They also added that removal of soil carbonate has decreased the adsorption of Zn and Cu. Pendias and Pendias (1992) stated that major soluble ions greatly influence the quantities of soluble trace elements, so these ions play an important role governing trace elements availability to plants. Solutions of Most soils contain an access of Ca^{2+}, which in many cases constitutes more than 90% of the total cation concentration. Therefore Ca^{2+} is considered to be the most important cation governing the soluble state of trace elements in soils. They added that there are examples of soils in which complex trace cations prevent precipitation in the presence of Ca^{2+} in soil solutions having a relatively high pH level, even higher than normal concentration.

MATERIALS AND METHODS

This study aims to obtain some information regarding the importance of the specific adsorption of some heavy metals, namely copper and zinc, in heavy clay soils North east Nile Delta as a contribution to dealing with heavy metals contamination.

The study area (Fig:1) located at the north eastern part of the Nile Delta of Egypt, extends between latitudes $30^{\circ} 20^{"}$ N and $31^{\circ} 10^{"}$ N longitudes $31^{\circ} 50^{"}$ E and $32^{\circ} 10^{"}$. It covers parts of Dakahlya and Sharkia governorates. The area is bounded by EL-Manzala Lake on the north, Seuz canal in the east, Damietta Nile branch in the west and Cairo Ismailia desert road in the south.
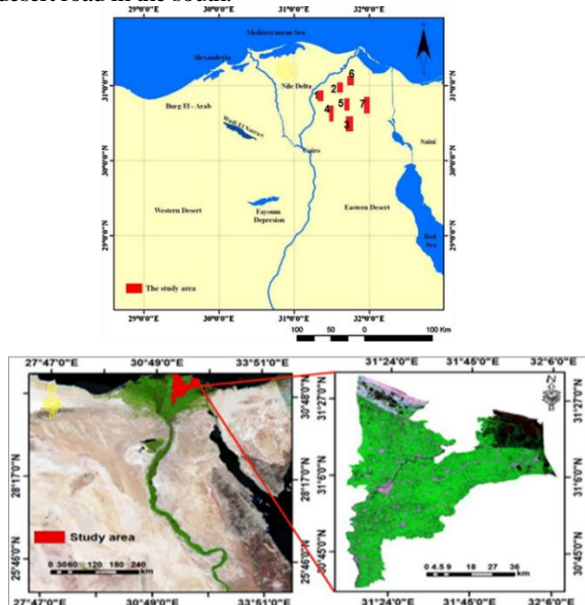

Fig. 1. Locations of the studied profiles.

Climate:

The selected area is arid characterized by long hot rainless summer, short rainy winter, high evaporation rate and low relative humidity.

Soil profiles:

Seven soil profiles representing the main soils in the north eastern part of the Nile Delta of Egypt were studied. They were morphologically described in the field. according to the USDA, (2012). Soils samples were finely grounded crushed to pass through 2 mm sieve and stored for analyses. Soil Physical and chemical analyses were carried out according to Soil survey laboratory methods (USDA, 2004).

Cation exchange capacity (CEC) was determined according to the method mentioned in Richards (1954).Total N was determined by the micro-kjeldahl method as described by Jackson (1963). Available K and P were extracted by ammonium bicarbonate diethylene triamine pentoacetric acid (AB/DTPA), Soltanpour and Schwab (1977). Potassium content was determined photometrically using Flame photometer as described by Chapman and Pratt (1982). Phosphorus content was determined using spectrophotometer according to FAO Soil Bulletin (1989). Exchangeable cations were determined using sodium and ammonium acetate as outlined by Bower (1959). Available N was extracted by 2m KCl and determined by the micro Kjeldahl, Mulvaney (1996). The mineralogical composition of the studied soils was determined by X- Ray Fluorescence (XRF) (Philips, PW2400).

Specific adsorption experiments:

The specific adsorption experiments were carried out on the surface (a) and subsurface (b) soil samples of profiles No. (1, 2, 3 and 4) as follow:

Specific adsorption in presence of Na- acetate:

The specific adsorption of Cu and Zn was measured by shaking 10 gm soil for 24hrs with 50ml Na-acetate (1.N) pH 8 solutions containing (0.0 , 0.004 , 0.008 and 0.012) meq / Cu (the same with Zn), Mclaren and Crawford (1973). Once in solution Cu as well as Zn was determined by (ASS) Atomic absorption spectrophotometer.

Specific adsorption in presence of Ca- acetate:

The same as the aforementioned experiments were carried out using Ca- acetate (1.N) pH 8 solutions.

RESULTS AND DISCUSSION

Soil Characteristics:

The morphological characteristics of soil profiles are shown in Appendix (Table.1). The soil profiles represent vertisols soil order Torrerts and Haplotorrerts, Samy, et al., (2017). The Physical and chemical properties of the studied soil profiles are shown in Tables 2, 3.a, 3.b, 4 and 5. The Figures are shown in 2, 3, 4, 5 and 6. The obtained results (Table.2) indicated that soil texture ranged from silty to clayey. The clay contents ranges from 37.7% to 46.5% and the structure varies from granular to strong angular blocky. It is evident from (Table.3.a) that electrical conductivity values of the saturation extract indicate that the soil profiles are low to moderately saline, whereas total soluble could be extremely high. Electrical conductivity values of these soils vary from 1.4 to 32.7 ds/m. The data indicated also that the soils are almost neutral to slightly alkaline, as the pH values ranged between 7.5 to 9.7. The soil organic matter contents ranged from 0.2 to 3.6 %. Soluble cations and anions could be arranged in the following descending order $Na^+ > Mg^{++} > Ca^{++} > K^+$ vs $SO_4^- > Cl^- > HCO_3^-$ in the different soil profile

layers. The data in (Table. 2) as well as the ratio of SO_2/Al_2O_3 (≥ 3) in (Table.5) led to the conclusion that the smectite clay minerals are the dominant mineralogical composition of the all studied soil profiles.

Concerning soil fertility Table (4), the available nitrogen ranged from 10.08 to 50.4 ppm in these soils,

according to Dahnke and Johnson (1990) these values indicated that the soils had low levels of available nitrogen, as well as low levels of available phosphorus which ranged from 1.1 to 12.06 ppm.

Table 1. Main morphological features of soil profile.

Soil Profiles	Depth	Color		Texture	Structure	Consistence			
		Dry	Moist			Dry	Mst	Stk	Pls
Elmansoura	0-25	10YR2/3	10 YR3/3	C	GR	Vh	sh	VS	VP
	25-50	10YR3/2	10 YR3/3	C	ABK	Vh	fi	VS	VP
	50-120	10YR2/2	10YR 3/2	C	SBK	Vh	fi	VS	VP
Kafr Sakr	0-20	10YR4/2	10YR4/3	C	GR	Vh	sh	VS	VP
	20-40	7.5YR41	7.5YR4/4	C	ABK	Vh	sh	VS	VP
	60-110	7.5YR4/3	7.5YR4/4	C	ABK	Vh	sh	VS	VP
Menia ElKamh	0-30	10 YR 4/3	10 YR3/3	C	ABK	Vh	fi	VS	VP
	30-55	10 YR4/2	10 YR3/3	C	SBK	Vh	fi	VS	VP
	55-130	7.5YR4/2	10 YR3/3	C	SBK	Vh	fi	VS	VP
Deiarb Nigm	0-25	10 YR4/2	10 YR3/3	C	SBK	Vh	fi	VS	VP
	25-50	10 YR3/1	10 YR3/2	C	SBK	Vh	Sh	VS	VP
	50-110	10 YR4/3	10 YR3/3	C	ABK	Vh	Sh	VS	VP
Zagazig	0-30	7.5YR4/2	10YR2/3	C	GR	Vh	Sh	VS	VP
	30-60	7.5YR3/3	10YR3/4	C	GR	Vh	Sh	VS	VP
	60-120	10 YR3/2	10YR2/3	C	GR	Vh	Sh	VS	VP
Abo kabier	0-25	10 YR4/2	10YR4/3	C L	SBK	Vh	Sh	VS	VP
	25-50	10YR4/3	10YR3/3	C L	GR	Vh	Sh	VS	VP
	50-100	10 YR 4/2	10 YR 4/3	C L	GR	Vh	Sh	VS	VP
Belbeis	0-30	10 YR3/2	10YR2/3	C	GR	Vh	Sh	Vfi	VP
	30-55	10YR3/2	10YR2/2	C	SBK	Vh	Sh	VS	VP
	55-110	10 YR 2/2	10 YR 2/3	C	SBK	Vh	Sh	VS	VP

Table 2.Some physical characteristics of the studied soil profiles.

Soil Profiles	depth cm	Particle size distribution (%)			Texture class	Particle Density (g/cm³)	Bulk Density (g/cm³)
		Sand	Silt	Clay			
Elmansoura	0-25	23.24	30.48	46.28	Clay	2.26	1.8
	25-50	21.28	32.4	46.32	Clay	2.27	1.9
	50-120	23.16	30.36	46.48	Clay	2.32	1.6
Kafr Sakr	0-20	23.49	30.3	46.21	Clay	2.41	1.8
	20-40	23.35	31.22	45.43	Clay	2.31	2
	60-110	23.46	32.03	44.51	Clay	2.28	1.6
Menia ElKamh	0-30	21.42	32.09	46.49	Clay	2.26	1.6
	30-55	31.46	30	38.54	Clay	2.28	2
	55-130	29.44	30.06	38.50	Clay	2.25	1.9
Deiarb Nigm	0-25	29.4	29	41.6	Clay	2.29	1.6
	25-50	30.43	30	39.57	Clay	2.21	2
	50-110	29.34	32.96	37.7	Clay	2.31	1.9
Zagazig	0-30	28.41	31.11	40.48	Clay	2.45	1.9
	30-60	28.44	30.12	41.44	Clay	2.54	1.9
	60-120	28.48	33.46	38.06	Clay	2.88	1.5
Abo kabier	0-25	23.39	42.1	34.51	Clay Loam	2.78	1.8
	25-50	31.33	40.19	28.48	Clay Loam	2.95	1.9
	50-100	32.41	36	31.59	Clay loam	2.95	2
Belbeis	0-30	29.43	28	42.57	Clay	2.45	1.9
	30-55	24.55	30	45.45	Clay	2.22	1.9
	55-110	25	30	45	Clay	2.72	1.9

Table 3.a. Some chemical characteristics of the studied soil profiles.

Soil Profiles	Depth cm	EC dS/m	PH	Soluble cations meq/L				Soluble anions meq/L		
				Na+	K+	Ca++	Mg++	CL-	HCO3-	SO4=
Elmansoura	0 - 25	2.68	7.94	13.67	0.09	6	7	5	3	18.76
	25 - 50	2.84	8.03	16.82	0.1	5.5	6	5	4.5	18.92
	50-120	3.65	8.07	20.42	0.08	12	4	6.5	4	25.5
Kafr Sakr	0 - 20	2.85	7.53	9.33	0.18	10	9	3.2	3.5	21.31
	20-40	1.58	8.04	7.64	0.11	6	2	3	3	9.25
	60-110	3.3	8.02	16.34	0.16	7.5	9	3	2.5	27
Menia ElKamh	0 - 30	1.95	8	5.88	0.13	5.5	8	1.2	4.5	13.31
	30-55	1.4	8.43	5.95	0.07	8	0	2.5	3	8.52
	55-130	1.16	8.65	6.48	0.13	5	0	1	3.5	6.61
Deiarb Nigm	0 - 25	2.51	8	12.85	0.21	8	4	7.2	5.5	11.86
	25-50	2.23	8.89	13.67	0.11	8.5	0	2.5	6	13.28
	50-110	1.72	9.3	12.14	0.1	5	0	3.2	4.5	9.04
Zagazig	0 - 30	2.09	8.17	11.65	0.21	7.5	1.5	3.5	8.5	8.36
	30-60	1.63	8.56	9.25	0.09	7	0	2.2	4.5	9.14
	60-120	1.41	8.51	8.99	0.08	5	0	1.5	4	8.07
Abo kabier	0 - 25	32.73	8.93	283.71	1.08	20	22.5	44.5	2.5	279.79
	25-50	0.82	9.7	2.51	0.2	5.5	0	3.5	5	0.21
	50-100	1.84	9.33	8.2	0.19	10	0	3.2	4.5	10.19
Belbeis	0 - 30	1.54	8.82	9.85	0.09	5.5	0	2.5	4	8.44
	30-55	1.64	8.9	9.36	0.06	7	0	2.2	3	10.72
	55-110	3.04	8.81	12.29	0.09	7.5	10.5	2.5	5	22.38

Table 3.b. Some chemical characteristics of the studied soil profiles.

Soil Profiles	depth cm	Exchangeable ions meq /100g Soil				ESP	% Total		
		Na	Ca	K	Mg		N	P	K
Elmansoura	0 - 25	9.7	33.0	0.8	1.8	21.44	0.21	0.03	0.12
	25 - 50	12.5	36.0	0.8	1.7	24.46	0.15	0.02	0.14
	50 - 120	14.0	38.0	0.7	1.5	25.85	0.40	0.02	0.12
Kafr Sakr	0 - 20	6.6	42.0	1.3	1.4	12.89	0.15	0.10	0.21
	20 – 60	7.8	38.0	1.2	1.7	16.03	0.09	0.02	0.12
	60 - 110	8.6	37.0	1.0	1.0	18.01	0.09	0.02	0.19
Menia ElKamh	0 - 30	5.5	37.0	1.1	1.6	12.09	0.06	0.01	0.16
	30 - 55	8.2	41.0	1.0	1.5	15.84	0.06	0.07	0.16
	55 - 130	8.2	32.0	1.0	1.6	19.11	0.05	0.04	0.15
Deiarb Nigm	0 - 25	10.1	36.0	1.5	1.8	20.49	0.46	0.002	0.17
	25 - 50	12.1	30.0	1.3	1.9	26.66	0.15	0.002	0.15
	50 - 110	16.0	27	1.2	1.6	34.86	0.13	0.10	0.19
Zagazig	0 - 30	7.0	39.0	1.3	1.3	14.44	0.06	0.002	0.11
	30 - 60	7.4	33.0	0.8	2.2	17.03	0.05	0.04	0.13
	60 - 120	8.2	43.0	0.8	1.6	15.24	0.09	0.12	0.11
Abo kabier	0 - 25	15.6	24.0	1.4	0.8	37.22	0.10	0.06	0.12
	25 - 50	7	25.0	1.0	0.7	20.79	0.05	0.02	0.11
	50 - 100	8.2	30.0	1.1	0.7	20.42	0.06	0.02	0.11
Belbeis	0 - 30	9.3	39.0	2.2	1.6	17.92	0.05	0.06	0.13
	30 - 55	9	37.0	2.0	1.5	18.12	0.05	0.04	0.13
	55 - 110	9	38.0	0.7	2.1	18.02	0.05	0.05	0.11

Table 4. Some chemical characteristics and available NPK of the studied soil profiles.

| Soil Profiles	depth cm	Gypsum %	CEC	CaCO$_3$ %	O.M %	Available (ppm)		
						N	P	K
Elmansoura	0 – 25	1.3	43.52	4.60	2.97	17.62	5.0	0.12
	25 – 50	1.2	46.40	5.52	1.99	10.08	5.0	0.14
	50 -120	1.1	46.40	11.5	0.93	10.08	3.9	0.12
Kafr Sakr	0 – 20	0.8	40.00	7.36	3.29	38.02	6.3	0.21
	20 – 40	0.9	40.64	8.74	1.16	12.6	6.1	0.12
	60 – 110	1.6	40.32	4.60	0.64	11.34	2.6	0.19
Menia ElKamh	0 – 30	1.5	39.04	6.90	1.15	20.16	6.7	0.16
	30 – 55	1.3	41.60	3.68	0.86	15.12	6.7	0.16
	55 – 130	1.2	40.96	3.22	0.72	15.12	4.6	0.15
Deiarb Nigm	0 – 25	1.0	56.64	11.50	0.76	50.4	4.3	0.17
	25 – 50	1.1	41.28	7.36	1.25	20.16	4.3	0.15
	50 – 110	0.9	43.84	11.50	0.82	15.12	3.3	0.19
	0 – 30	1.2	41.6	4.6	3.65	70.57	8.9	0.11
Zagazig	30 – 60	1.6	36.8	3.22	1.18	20.16	3.7	0.13
	60 – 120	1.4	46.72	1.84	0.82	17.64	10	0.11
Abo kabier	0 – 25	1.3	14.72	3.22	1.5	30.24	12.6	0.12
	25 – 50	1.5	10.88	2.76	0.63	15.12	4.3	0.11
	50 – 100	0.7	22.08	1.38	0.66	15.12	1.1	0.11
Belbeis	0 – 30	1.9	62.08	3.68	1.04	15.12	4.8	0.13
	30 – 55	0.8	42.88	2.3	0.75	10.08	2.6	0.13
	55 – 110	0.9	49.6	3.22	0.82	10.8	7	0.11
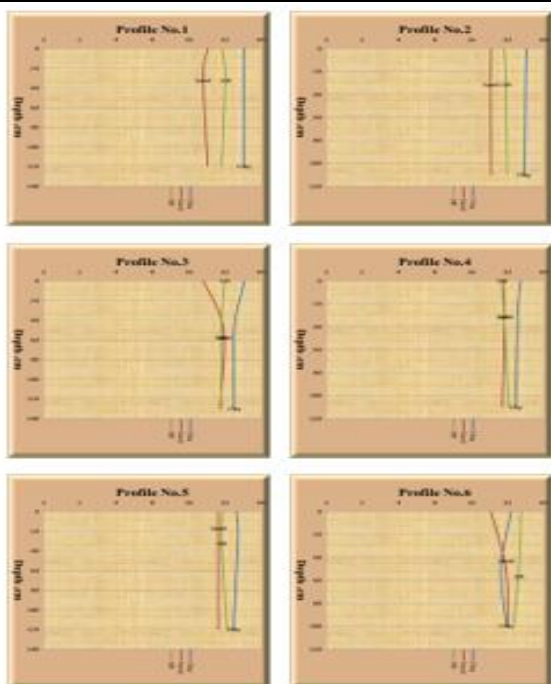
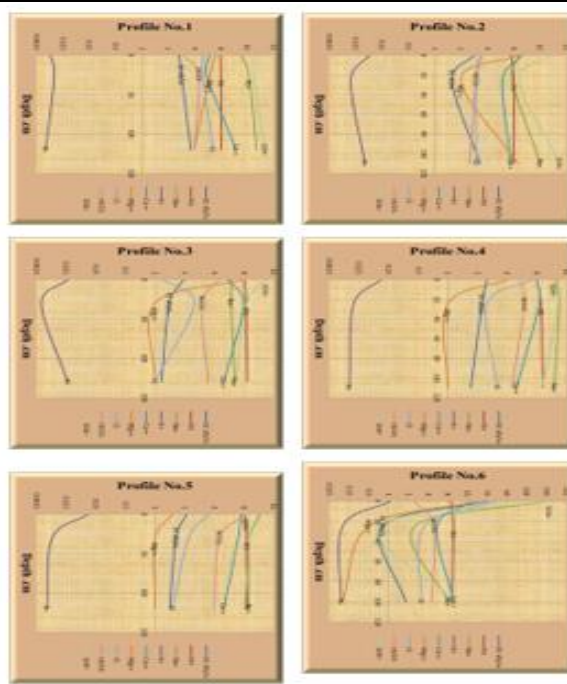**Fig. 2. Vertical distribution of Sand, Silt and Clay.**

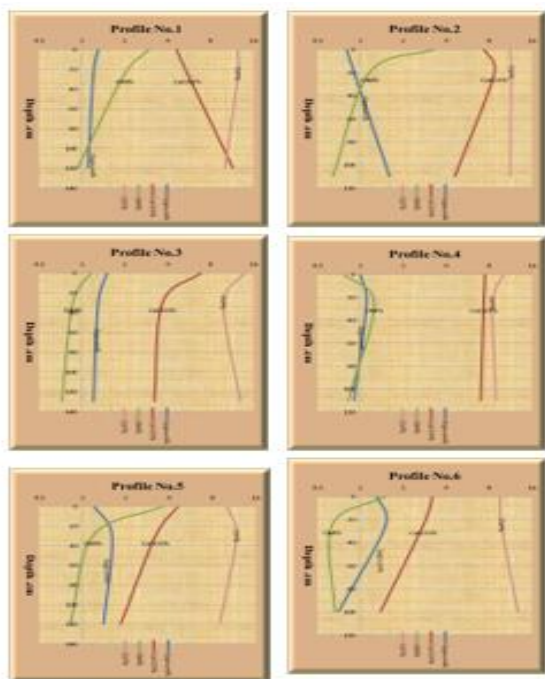**Fig. 3. Vertical distribution of EC, PH and soluble ions.**

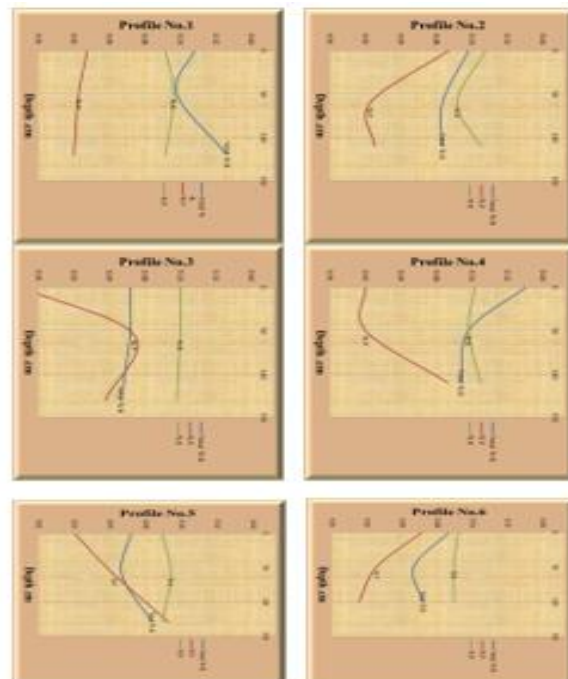**Fig. 4. Vertical distribution of %OM, %CaCo3, Gypsum and ESP.**
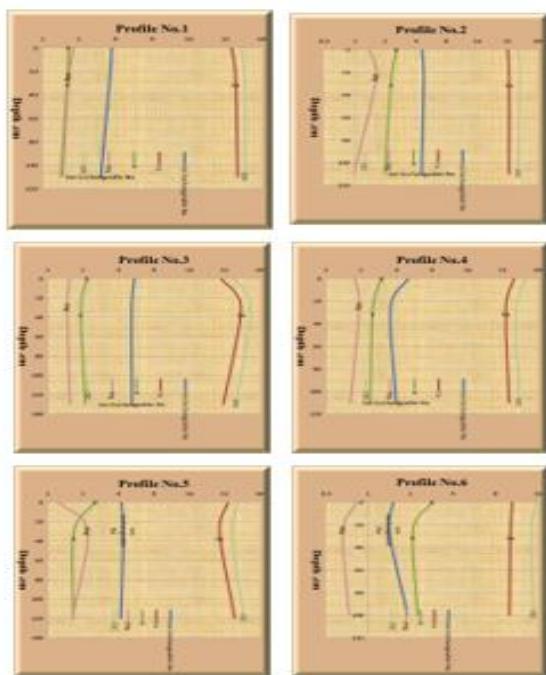

Fig. 6.Vertical distribution of Total NPK.

Available potassium ranged from 253.7 to 868.4 ppm. According to the index values reported by Soltanpour and Schwab (1977), available phosphorus and potassium occurred at low levels so that they considered to be insufficient for plant growth. The data in Table (4) also showed the calcium carbonate contents to range between 1.3% and 7.5%. Gypsum contents were low ranging between 0.8% and 1.9%. Cation exchange capacity (CEC) of the soil samples varied between 14.3 and 52.5 cmol/kg soil. The high values of the CEC in addition to the high clay contents. Table (3.b) showed Total contents of nitrogen to range between 0.05 to 0.46 %. Total phosphorus ranged from 0.00 to 0.12 %. Total potassium ranged from 0.11 to 0.19 %.

Fig. 5. Vertical distribution of ion exchangeable and CEC.

Table 5. The percent of some total element oxides of some soil profiles.

Profil No.	depth cm	CuO	ZnO	MnO	CdO	Fe2O3	Al₂O₃	SiO₂	SiO₂ /Al₃
1	0 – 25	0.01	0.01	0.13	0	11.07	14.47	43.94	3.03
	25 – 50	0.02	0.01	0.15	0	11.51	15.00	45.35	3.02
2	0 – 20	0.00	0.01	0.14	0	10.17	13.3	46.20	3.40
5	0 – 30	0.01	0.01	0.16	0	11.06	14.16	45.95	3.20
	30 – 60	0.02	0.01	0.16	0	11.22	14.95	48.00	3.20
7	0 – 30	0.00	0.01	0.16	0	10.85	14.60	48.06	3.20

Specific adsorption experiments:

This research was conducted to study the state of copper and zinc with special emphasis on their specific adsorption by heavy clay soils. Moreover, an attempt was made to assess the absorption of these heavy metal ions from soils under variable equilibrium concentrations: (0 - .004 -

.008 - .012 meq/l), in (1 : 5) soil /solution ratio.The results also showed the specific adsorption of copper as well as zinc ions in the presence of sodium, as a monovalent cation and calcium as a divalent cation. It is evident shown from (Tables. 6 & 7) and (Fig. 7,7.a) for copper as well as from (Tables: 8 & 9) and (Fig.8, 8.a) for zinc that the higher the

concentration of the added equilibrium solutions, the higher the specific adsorption which could be shown and represented by straight line equations for copper and zinc. Senia Mellouk et al. (2011) assured that in the presence of calcium, decreased the specific adsorption of copper and zinc, as calcium occupies all exchange sites on the adsorption complex. However in the presence of calcium, the specific adsorption in the surface soil layers were higher than that in the sub-surface layers. This could be attributed to the presence of organic matter and together with the clay content as was stated by Cavallaro and McBride (1978) and McBride (1980).

Form the mean values of the specific adsorption (Tables. 6,7, 8 and 9) and (Fig. 9); it could be concluded that the specific adsorption of copper exceeds that of zinc (Cu > Zn).

Table 6. The specific adsorption of Cu, in presence of Na-acetate.

Profile No.	depth cm	The specific adsorption of Cu, Na -acetate. (meq/l) in (1 : 5) soil / solution ratio.						
		Control	0.004	0.008	0.012	Clay%	CEC	CaCO3%	O.M%
1	0 - 25	0	1.96	3.91	5.86	46.2	45.4	4.6	3
	25 - 50	0	1.94	3.88	5.81	46.3	50.9	5.52	2
2	0 - 20	0	1.96	3.90	5.88	46.2	51.3	7.36	3.3
	20 - 60	0	1.94	3.88	5.81	45.4	48.6	8.74	1.2
3	0 - 30	0	1.96	3.93	5.87	46.5	45.1	6.9	1.2
	30 - 55	0	1.94	3.89	5.81	38.5	51.6	3.68	0.9
4	0 - 25	0	1.96	3.91	5.87	41.6	49.4	11.5	0.8
	25 - 50	0	1.94	3.88	5.81	39.5	45.3	7.36	1.3
Mean		0	1.93	3.89	5.83	43.8	48.5	7	1.7

Table 7.The specific adsorption of Cu, in presence of Ca-acetate.

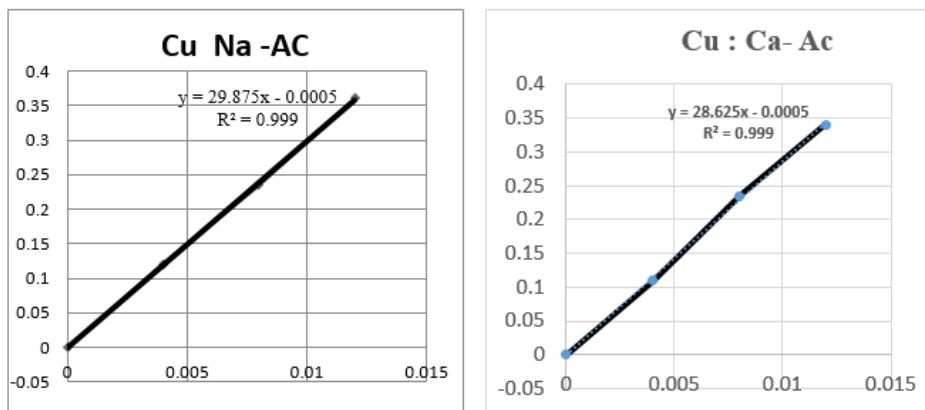| Profile No.	depth cm	The specific adsorption of Cu, Ca-acetate. (meq/l) in (1 : 5) soil / solution ratio.						
		Control	0.004	0.008	0.012	Clay%	CEC	CaCO3%	O.M%
1	0 - 25	0	1.95	3.89	5.83	46.2	45.4	4.6	3
	25 - 50	0	1.94	3.88	5.80	46.3	50.9	5.52	2
2	0 - 20	0	2.00	3.89	5.85	46.2	51.3	7.36	3.3
	20 - 60	0	1.94	3.88	5.80	45.4	48.6	8.74	1.2
3	0 - 30	0	1.94	3.89	5.84	46.5	45.1	6.9	1.2
	30 - 55	0	1.94	3.88	5.79	38.5	51.6	3.68	0.9
4	0 - 25	0	1.95	3.90	5.83	41.6	49.4	11.5	0.8
	25 - 50	0	1.95	3.88	5.82	39.5	45.3	7.36	1.3

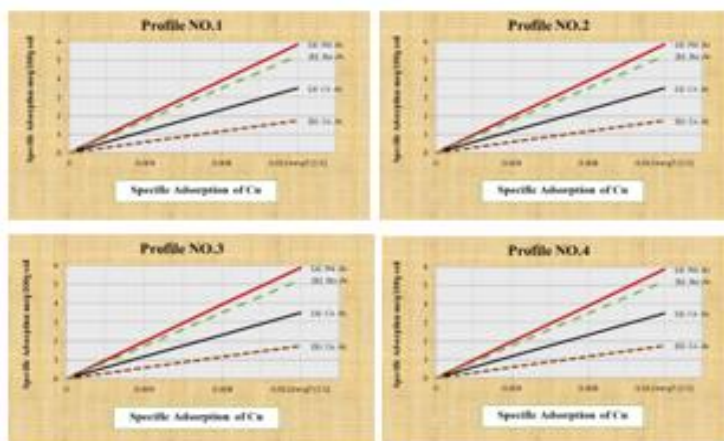**Fig 7. The specific adsorption of Cu in presence of Na- and Ca-Acetate.**

Fig. 7.a. Specific adsorption of Cu (meq/100g soil), as Cu-ions added to 1n PH8 Na and Ca-acetate solutions (1:5).
(a) Surface soil layers, (b) Subsurface soil layers

Table 8. The specific adsorption of Zn , Na-acetate.

Profile No.	depth cm	The specific adsorption of Zn, Na acetate. (meq/l) in (1 : 5) soil / solution ratio.				Clay%	CEC	CaCO3%	O.M%
		Control	0.004	0.008	0.012				
1	0 - 25	0	1.95	3.92	5.89	46.2	45.4	4.6	2.97
	25 - 50	0	1.93	3.89	5.81	46.3	50.9	5.52	1.99
2	0 - 20	0	1.94	3.90	5.88	46.2	51.3	7.36	3.29
	20 - 60	0	1.92	3.88	5.81	45.4	48.6	8.74	1.16
3	0 - 30	0	1.94	3.89	5.86	46.5	45.1	6.9	1.15
	30 - 55	0	1.93	3.87	5.80	38.5	51.6	3.68	0.86
4	0 - 25	0	1.93	3.89	5.88	41.6	49.4	11.5	0.76
	25 - 50	0	1.93	3.87	5.79	39.5	45.3	7.36	1.25
Mean		0	1.93	3.89	5.83	43.8	48.5	7	1.7

Table 9. The specific adsorption of Zn , Ca-acetate.

| Profile No.	depth cm	The specific adsorption of Zn, Ca acetate. (meq/l) in (1 : 5) soil / solution ratio.				Clay%	CEC	CaCO3%	O.M%
		Control	0.004	0.008	0.012				
1	0 - 25	0	1.91	3.85	5.78	46.2	45.4	4.6	2.1
	25 - 50	0	1.91	3.85	5.79	46.3	50.9	5.5	1.9
2	0 - 20	0	1.91	3.84	5.78	46.2	51.3	7.3	3.2
	20 - 60	0	1.91	3.84	5.79	45.4	48.6	8.7	1.1
3	0 - 30	0	1.92	3.85	5.78	46.5	45.1	6.9	1.1
	30 - 55	0	1.91	3.87	5.79	38.5	51.6	3.6	0.8
4	0 - 25	0	1.91	3.84	5.79	41.6	49.4	11.5	0.7
	25 - 50	0	1.91	3.86	5.79	39.5	45.3	7.3	1.2
Mean		0	1.91	3.85	5.79	43.8	48.5	7	1.7
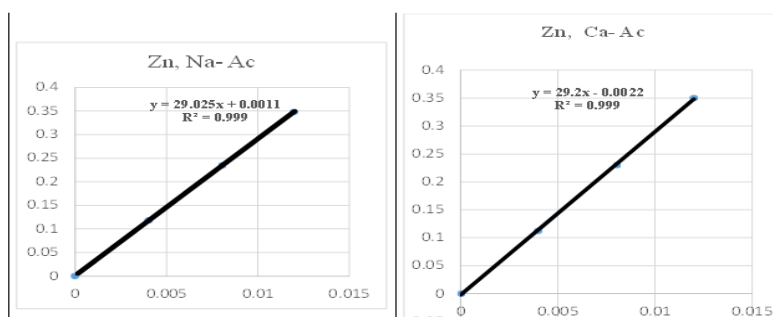
Fig 8.The specific adsorption of Zn in presence of Na- and Ca-Acetate.
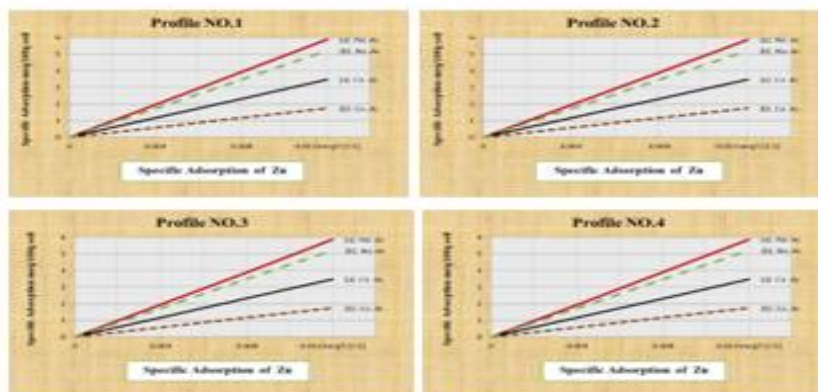

Fig. 8.a. Specific adsorption of Zn (meq/100g soil), as Zn-ions was added to 1N PH8 Na- and Ca-acetate, solutions (1:5).
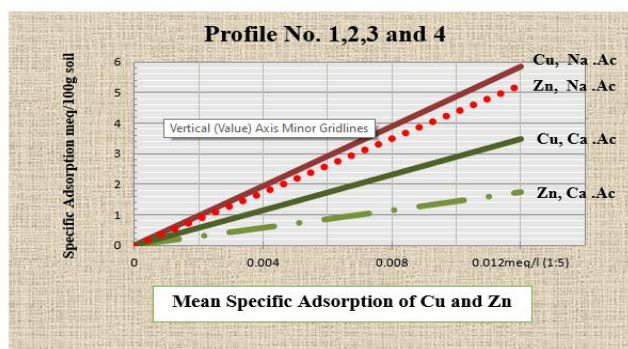**(a) Surface soil layers, (b) Subsurface soil layers**

Fig 9. Mean Specific Adsorption of Cu and Zn (meq/100g soil), as Cu and Zn -ions was added to 1N PH8 Na- and Ca-acetate, solutions (1:5).

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الأدمصاص النوعي للنحاس والزنك في التربة شمال شرق دلتا النيل.
حسن علي أحمد ، صلاح ابو العينين ، توفيق مسلم و أمير سامى حسان
قسم الاراضى والمياه كليه الزراعة جامعة الأزهر _ القاهرة

تناولت هذه الدراسة تأثير خواص التربة على إدمصاص النحاس و الزنك في اراضى شمال شرق دلتا النيل وقد أجريت هذه الدراسة على عينات التربة السطحية وتحت السطحية في سبعة قطاعات ذات الطبيعة للاراضى الطينية الثقيلة: حيث تهدف هذه الدراسة إلى إلقاء الضوء على تأثير خواص التربة على إدمصاص النحاس و الزنك ولتحقيق هذا الهدف تمت دراسة. انطلاق النحاس و الزنك. اوضحت النتائج السابقة في دراسه الادمصاص النوعي على أيونات النحاس والزنك في وجود الصوديوم كاكاتيون أحادي والكالسيوم كاكاتيون ثنائي وكما هو موضح على رسم البياني انه كلما زاد التركيز زاد الادمصاص النوعي كما هو موضح بمعادلة الخط المستقيم علي الشكل البياني رقم 7 و 8 بالنسبة للنحاس والزنك بينما كان دور الصوديوم كاكاتيون احادي يساعد على ادمصاص النحاس والزنك في الطبقات السطحيه على عن الطبقات التحت السطحية نظرا لوجود الماده العضوية ومحتوى الطين بينما في وجود الكالسيوم قل الامدصاص النوعي سواء للنحاس او الزنك حيث ان الكالسيوم يشغل جميع مواقع التبادل علي معقد الادمصاص كاكاتيون ثنائى و في وجود الكالسيوم زاد الادمصاص في الطبقات السطحيه عن الطبقات التحت سطحية نظراً لوجود المادة العضوية ومحتوي الطين. وعلى ذلك فإنه على ضوء هذه الدراسة يلزم الحذر الشديد من التلوث بالنحاس والزنك في الأراضي المرتفعة في نسبة الطين أو السعة التبادلية الكاتيونية وكذلك في الأراضي القلوية لما في ذلك من خطر شديد على كلا من النبات والإنسان والحيوان.