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FRACTIONATION AND DISTRIBUTION OF SOIL IRON AND MAGNGANESE IN SOME EGYPTIAN SOILS

Abd Allah, S. A., Nadia, A. Mohamed., Samy A. El-Shikhah

Soils, Water and Environment Res. Inst. M, Agric. Res. Center, Giza, Egypt.

ABSTRACT

Eleven soil profiles were selected to representing the Nile alluvial soils and fluvio marine soils for the distribution and chemical fractions of soil iron and manganese as well as some relevant soil characteristics such as ECe, pH, OM, $CaCO_3$ percentages and texture class. Statistical analysis was then preformed to correlate Fe and Mn fractions with soil constituents.

The obtained data indicate that the content of soil iron in the exchangeable, bounded with organic matter, Fe-Oxides , Fe-amorphous, Fe-crystalline, Sand, silt and clay fractions varied from 3.3 to 24.8; 1.15 to 17.8, 75 to 480, 1900 to 7700, 10300 to 16900, 230 to 6570m 1388 to 9420 and 28300 to 45230 µg g^{-1} respectively. In alluvial soils, while in the faluvio marine soil, the content of soil iron ranged from 1.3 to 22.1, 0.2 to 12.3, 270 to 480, 1251 to 3685, 11320 to 16560, 1000 to 3430, 2160 to 8640 and 26590 to 40650 µg g^{-1} respectively.

Generally, the highest values of Fe were found in the clay fraction, while the lowest contents were found in the sand fraction in the studied soils. Also Fe fractions in the studied soils can be ranged in the order:

Clay>Fe-crst.>silt>Fe-Amor.>sand> Fe-oxides> Exch-Fe> Fe-OM.

With regard to the distribution of soil Mn, data reveal that Exch.-Mn, OM-Mn, Mn-oxideas, Mn-Amorphus, Mn-Crystalline, Sand fraction, Silt fraction and clay fraction in the alluvial soil varied from

0.5 to 7.5, 0.1 to 1.3, 66.8 to 290.3, 71.0 to 212.6. 28.4 to 162.1, 12.2 to 91.8, 14.1 to 192.3 and 13.1 to 77.5 µg g^{-1} respectively. In the fluvio marine soils, Mn fractions varied from 0.6 to 5.4, 0.1 to 2.4, 110.2 to 280.4, 35.7 to 160.7, 28.6 to 118.8, 6.7 to 91.7, 22.6 to 119.1 and 10.4 to 45.3 µg g^{-1} for Exch.-Mn, OM-Mn, Mn-Oxides, Mn-Amprphous, Mn-Crystalline, Sand , silt and clay fractions, respectively. Also, Mn fractions in the studied soils can be ranged in the order:

Mn-Oxides> Mn-Amorphous> Mn-Cryst.> silt>sand>clay>Mn-Ech.>Mn-OM.

Factor affecting between Fe and Mn fractions and some soil variable were predicted through correlation coefficients which were computed and discussed.

INTRODUCTION

Sequential extraction pro coheres use to separate, chemical forms of elements especially metals, are binge impaled in the study of soils and sediments. There techniques are useful to the environmentalist, who uses them primarily in research dealing with sewage sludge or sediments. Soil chemists use these schemes also to investigate native form of micronutrients in soil fixation and mobility of micronutrients in soils. Kabata Pendias and Pendias (1992) used a sequential extraction scheme to partitioning of trace metals money the various geochemical phases of sediments Singh (1997) also employed this technique study march substrate fraction, andNa and Rao, 1977 used it do determine trace metals binding to sacriticial sediments. Ahumada et al. (1999) employed sequential extraction to investigate heavy metals as contaminations in street dusts and roadside soils. Sequential extraction has also been important in contamination studies from metal smelters (Kuo et al., 1983) and industrial complexes Chlopecka et al. (1996). Anther field using fractionation procedures extensively is swage sludge investigations, as in Sposito et al.(1982).the technique has been put to other agronomic use (Lyengar et al., 1981). Kennedy et al. (1997) evaluate a sequential extraction procedure to separate chemical forms of soil micronutrients. Norvel (1988) studied the distributions of soil iron and manganese in sequentially extractable forms. Under the Egyptian soils, Hegazy et al. (1991) studied iron contents in different fractions. He studied the amounts of iron in exchangeable, adsorbed, organic, carbonate and sulfite fractions. Also, AbdAlla (2000) used different extraction methods (DTPA, HCl, NH_4OAC and NH_4OAC+ 0.02% Hydroquinone for some micronutrients (Fe, Mn, Zn and Cu).

Kasawenth (1971) classified soil iron into the following (1) water soluble (2) exchangeable and (3) non-exchangeable. Water soluble iron fraction is readily available for plant uptake and when soil solution is depleted of Fe, both exchangeable and non-exchangeable forms are two sources that replenish soil solution with this elements. Manganese like any other micronutrients is highly indispeuable for plant. This element is belived to be available to plants in Mn^{+2} from and the supply comes from water-soluble, exchangeable and easily reducible fractions present in soils Pickering (1986). All these forms of Mn are in equilibrium with each other and the cource of reaction is governed by a number of factors like moisture, organic matter, soil reaction, Oxidation-reduction potential, soil texture and activity of microorganisms.

The objective of this work points to investigate the distribution and chemical forms Fe in alluvial and fluvio marine soils of Egypt and investigate the relationship between soil properties and chemical fractions of Fe and Mn in the studied soils.

MATERIALS AND METHODS

Physical and chemical properties for the eleven soil profiles used the fraction procedure are given in Table 1. Soil properties were determined using standard methods (Page et al., 1982). Soils were selected to be representative of Nile alluvial plain (profiles Nos: 1, 2, 3, 4, 5, 6) and fluvio marine plain. (Profiles Nos: 8, 9, 10, 11) of El-Beherira governorates. Some physical and chemical properties were determined according to Page et al., (1982).

The distribution of Fe, and Mn in the studied soils into various forms was determined by sequent extraction methods. Magnesium nitrate was used for the exchangeable ions instead of $MgCl_2$ (Shuma 1979). The organic matter extraction was carried out according to Shuman (1985). The Mn oxide extraction was after Chao (1972). And the amorphous Fe oxide method was that of McKeague and Day (1966). Crystalline Fe oxide method was devised by Shuman (1985).

Separation of clay. Silt and sand was carried out according to the method described by Shuman (1985).

The separation of the solids was carried out using 8 g of soil. The soil was extracted twice for crystalline Fe oxides at soil-to solution ratio of 8:50 to rid it of Mn and Fe oxides. The separation was carried out as before (Shuman 1979), using wetsiveing for the sand and centrifuging and decantation to separate the silt and clay.

The soil separates were digested using HF, HNO_3 and HCl as were whole soil samples (Shuman 1979). All extract solutions were centrifuged and filtered after shaking or heating with the soil. The percentage of each microelement in the various fractions was calculated based on the sums of the parts.

The content of Fe and Mn fractionations solutions were determined by the atomic absorption spectrophotometer, Perkien Elmer, 2380.

Data were statistically analyzed according to Snedecore and Cochran (1967).

RESULTS AND DISCUSSION

Soil properties

Data of physical and chemical properties of the studied soil profiles are presented in Table (1 and 2). Data indicate that soil texture class of the Nile alluvial soils is clay throughout the entire profile depths, except for the surface layers of profile 7 where the soils have clay loam texture class. $CaCO_3$ content of the Nile alluvial soils varies from 0.7 to 4.6%. The low content of $CaCO_3$ of the Nile alluvial soils may be due to the nature of parent materials. Organic matter content was very low and did not exceed 3.8% of the soil components. The low content of organic matter is common feature in soils of the arid regions due to the high oxidation potential and climate conditions. Soils are neutral to strongly alkaline indicating by the pH values which varied from 7.3 to 8.7. ECe values ranged from 0.8 to 12.26 dSm^{-1} indicate that the soils are non saline to moderately saline.

Regarding to the fluvio marine soils, data in Tables (1 and 2)reveal that the soil reaction ranged from 7.5 to 8.0 indicating that the soils are slightly alkaline to moderately alkaline, the soils are non saline to strongly saline (ECe varied from 1.1 to 27.9 dSm^{-1}). Soil texture class are clay throughout the entire profile depth where clay content varied from 42.9 to 72.2% $CaCO_3$ content varied between 0.5 and 36.6% with irregular distribution pattern with depth. Organic matter content ranged from 0.4 to 2.4 with high content in the surface layers.

Table (1): Particle size distribution, $CaCO_3$ and organic matter contents of the studied soil profiles.

Phiso-graphic unit	Profile No.	Depth (cm)	Particle size distribution %				Textural class	$CaCO_3$ %	OM %
			Coarse sand	Fine sand	silt	clay			
Nile alluvial plain	1	0-20	3.6	19.7	23.8	52.9	Clay	4.6	2.6
		20-55	1.7	19.6	28.0	50.7	Clay	3.5	1.5
		55-100	1.6	18.8	26.8	52.8	Clay	2.3	1.5
		100-150	2.0	17.5	24.5	56.0	Clay	2.3	1.3
	2	0-20	16.8	21.0	7.1	55.0	Clay	4.6	2.5
		20-50	15.3	15.0	14.6	55.1	Clay	3.9	3.8
		50-95	25.5	15.7	6.2	52.6	Clay	2.9	1.9
		95-150	17.8	19.6	9.8	52.7	Clay	2.8	1.9
	3	0-20	3.6	28.8	16.5	51.1	Clay	3.2	2.8
		20-60	1.2	24.7	17.8	56.3	Clay	3.2	2.2
		60-100	1.3	20.6	17.1	61.0	Clay	3.2	2.1
		100-150	0.5	17.6	19.7	52.2	Clay	1.6	2.1
	4	0-25	0.8	15.09	14.7	63.6	Clay	3.5	2.4
		25-65	2.9	15.2	20.4	61.5	Clay	3.9	2.4
		65-100	2.8	16.20	21.4	59.6	Clay	1.8	2.1
		100-150	2.3	17.00	21.8	58.9	Clay	3.2	2.2
	5	0-20	12.7	15.6	11.7	60.0	Clay	3.9	2.7
		20-60	13.4	15.3	5.7	65.6	Clay	2.5	2.6
		60-100	3.2	4.2	5.8	86.8	Clay	0.7	2.9
		100-150	3.0	3.4	6.4	87.2	Clay	1.2	2.8
	6	0-25	1.4	9.8	18.6	70.2	Clay	3.5	2.9
		25-70	1.4	8.7	16.7	73.2	Clay	2.5	2.6
		70-120	1.4	7.0	15.5	76.1	Clay	1.8	2.6
	7	0-25	1.4	37.3	28.3	33.0	Clay loam	2.5	2.4
		25-75	5.9	36.0	14.7	43.4	Clay	2.3	2.5
		75-150	1.9	23.4	13.1	61.6	Clay	3.5	2.6
Fluvio marine plaine	8	0-25	7.3	18.0	11.4	63.3	Clay	22.3	2.1
		25-55	15.0	17.7	11.7	55.6	Clay	34.7	0.5
		55-85	20.0	16.6	11.5	51.8	Clay	36.6	0.4
		85-110	9.8	31.6	11.0	47.6	Clay	20.2	0.4
	9	0-25	5.8	22.3	27.9	44.0	Clay	3.9	2.2
		25-50	5.0	22.8	29.3	42.9	Clay	2.1	2.1
		50-100	1.9	14.6	24.7	58.8	Clay	1.6	1.9
		100-150	1.6	16.0	26.5	55.9	Clay	0.9	1.9
	10	0-25	0.9	12.0	19.7	67.4	Clay	1.8	2.4
		25-75	0.8	12.8	20.3	66.1	Clay	0.5	2.2
		75-150	0.5	13.9	10.9	74.7	Clay	0.5	2.2
	11	0-25	2.2	22.9	24.2	50.7	Clay	0.9	1.6
		25-65	1.8	9.0	17.0	72.2	Clay	2.3	1.0
		65-150	2.6	19.9	17.8	59.7	Clay	7.1	0.8

Table (2): Chemical composition of the soil saturation extract of the studied soil profiles.

Phiso-graphic unit	Profile No.	Depth (cm)	Particle size distribution %				Textural class	$CaCO_3$ %	OM %
			Coarse sand	Fine sand	silt	clay			
Nile alluvial plain	1	0-20	3.6	19.7	23.8	52.9	Clay	4.6	2.6
		20-55	1.7	19.6	28.0	50.7	Clay	3.5	1.5
		55-100	1.6	18.8	26.8	52.8	Clay	2.3	1.5
		100-150	2.0	17.5	24.5	56.0	Clay	2.3	1.3
	2	0-20	16.8	21.0	7.1	55.0	Clay	4.6	2.5
		20-50	15.3	15.0	14.6	55.1	Clay	3.9	3.8
		50-95	25.5	15.7	6.2	52.6	Clay	2.9	1.9
		95-150	17.8	19.6	9.8	52.7	Clay	2.8	1.9
	3	0-20	3.6	28.8	16.5	51.1	Clay	3.2	2.8
		20-60	1.2	24.7	17.8	56.3	Clay	3.2	2.2
		60-100	1.3	20.6	17.1	61.0	Clay	3.2	2.1
		100-150	0.5	17.6	19.7	52.2	Clay	1.6	2.1
	4	0-25	0.8	15.09	14.7	63.6	Clay	3.5	2.4
		25-65	2.9	15.2	20.4	61.5	Clay	3.9	2.4
		65-100	2.8	16.20	21.4	59.6	Clay	1.8	2.1
		100-150	2.3	17.00	21.8	58.9	Clay	3.2	2.2
	5	0-20	12.7	15.6	11.7	60.0	Clay	3.9	2.7
		20-60	13.4	15.3	5.7	65.6	Clay	2.5	2.6
		60-100	3.2	4.2	5.8	86.8	Clay	0.7	2.9
		100-150	3.0	3.4	6.4	87.2	Clay	1.2	2.8
	6	0-25	1.4	9.8	18.6	70.2	Clay	3.5	2.9
		25-70	1.4	8.7	16.7	73.2	Clay	2.5	2.6
		70-120	1.4	7.0	15.5	76.1	Clay	1.8	2.6
	7	0-25	1.4	37.3	28.3	33.0	Clay loam	2.5	2.4
		25-75	5.9	36.0	14.7	43.4	Clay	2.3	2.5
		75-150	1.9	23.4	13.1	61.6	Clay	3.5	2.6
Fluvio marine plaine	8	0-25	7.3	18.0	11.4	63.3	Clay	22.3	2.1
		25-55	15.0	17.7	11.7	55.6	Clay	34.7	0.5
		55-85	20.0	16.6	11.5	51.8	Clay	36.6	0.4
		85-110	9.8	31.6	11.0	47.6	Clay	20.2	0.4
	9	0-25	5.8	22.3	27.9	44.0	Clay	3.9	2.2
		25-50	5.0	22.8	29.3	42.9	Clay	2.1	2.1
		50-100	1.9	14.6	24.7	58.8	Clay	1.6	1.9
		100-150	1.6	16.0	26.5	55.9	Clay	0.9	1.9
	10	0-25	0.9	12.0	19.7	67.4	Clay	1.8	2.4
		25-75	0.8	12.8	20.3	66.1	Clay	0.5	2.2
		75-150	0.5	13.9	10.9	74.7	Clay	0.5	2.2
	11	0-25	2.2	22.9	24.2	50.7	Clay	0.9	1.6
		25-65	1.8	9.0	17.0	72.2	Clay	2.3	1.0
		65-150	2.6	19.9	17.8	59.7	Clay	7.1	0.8

Iron fractions

Table (3) illustrates the obtained results of the representative soil profiles from the Nile alluvial and fluvio marine plains under investigation. Table (3) reveals that exchangeable Fe ranged from 3.3 to 24.9 µg g^{-1}, and from 1.3 to 22.1 µg g^{-1} in the alluvial and fluvio marine plains, respectively. Generally, the highest values of the Exch.Fe in the studied soils characterized the upper most surface layers, while the lowest values are detected in the deepest layers.

With regard to the iron bounded to organic matter sites in the alluvial soils ranged from 1.15 to 17.8 µg g^{-1}. The highest value was in the surface layer of profile5, whereas the lowest value was in the deepest layer of profile 6. In the fluvio marine soils, data show that Fe bound by organic matter ranged from 0.2 to 12.3 µg g^{-1}. The highest value is detected in the top layer of profile 10, while the lowest value is found in the deepest layer of profile 8. The small amount of Exch.Fe and Fe bound by organic matter in the studied soils may be due to the strong bound to specific sites on the surface of clay, $CaCO_3$ and organic matter constituents. These results agree well with those by Aboulrose et al. (1990). Also, the values of Ech-Fe fraction are higher than those in organic matter fraction for all the studied soils. These results are similar to those obtained by Abd-El-Rahman (1995) and Abdel-Aziz et al (2009).

Table (3) reveals that the distribution and levels of iron in manganese oxide, Fe in amorphous and crystalline iron oxides in the Nile alluvial soils ranged from 75 to 480 µg g^{-1}, 1900 to 7700 µg g^{-1} and 10300 to 16900 µg g^{-1}, respectively.

With regard to the fluvio marine soils, data in Table (3) show that the Fe in manganese oxide, Fe in amorphous and crystalline iron oxides varied between 270 and 480 µg g^{-1} , 1251 and 3685 µg g^{-1} and 11320 and 16560 µg g^{-1} , respectively.

It is clear that occluded iron was presented in very high amounts in the alluvial soils comparison to the fluvio marine soils. This may be due to that the alluvial soils have reached in iron and aluminum oxide. Almost results were obtained by El-Sayed (1988). Also, the value of iron in occluded three fractions follow the following arrangement.

Fe in crystalline iron oxides> Fe in amorphous > Fe in manganese oxides.

Data in Table (3) reveal that the distribution and levels of Fe in sand, silt and clay fraction very widely from 230 to 6570 µg g^{-1} , 1388 to 9420 µg g^{-1} and 28300 to 45230 µg g^{-1} , respectively in the alluvial soils, whereas in the fluvio marine soils, the values of the clay fraction ranged from 26590 to 40650 µg g^{-1} , from 2160 to 84640 µg g^{-1} in the silt fraction and from 1000 to 3430 µg g^{-1} in the sand fraction. In general, in the alluvial and fluvio marine soils, the highest values of Fe were found in the clay soils, while the lowest values were found in the sand fraction. These results agree well with those by Rabie et al. (19996).

Table (3): Iron contents (µg/g soil) of eight fractions for the studied soil profiles

Phiso-graphic unit	Profile No.	Depth (cm)	Exch.	O.M	Mn-oxides	Amo. Oxides	Crystalline iron oxides	Sand	Silt	clay
Nile alluvial plain	1	0-20	7.5	3.3	480	2855	13600	2727	6080	37300
		20-55	3.9	2.8	420	2630	13410	2340	7620	35410
		55-100	3.6	2.7	410	2850	13100	1410	7450	33110
		100-150	3.6	2.2	380	2910	12210	1315	7157	37310
	2	0-20	22.4	7.5	407	2530	15600	2170	3410	35400
		20-50	8.3	4.6	303	2640	14340	230	2980	35310
		50-95	5.3	2.4	320	2310	12115	2000	2685	33204
		95-150	4.5	2.1	300	2115	10300	1950	2470	32410
	3	0-20	10.3	3.4	230	2550	15110	2307	2330	31340
		20-60	5.6	3,1	210	2160	13315	2115	2190	35610
		60-100	4.6	2.3	205	2160	12340	1200	1388	3720
		100-150	3.3	2,6	190	2115	11680	1080	2115	37310
	4	0-25	15.5	7.5	113.0	2800	16900	4320	6450	35500
		25-65	6.2	2.15	118.0	2800	16900	3515	5420	34817
		65-100	5.4	1.45	77.2	2100	15500	2306	1681	32430
		100-150	4.8	1.31	75.0	1900	13600	1466	1850	32230
	5	0-20	24.8	17.8	211.0	7700	13800	3300	3500	38600
		20-60	8.5	3.35	190.0	5800	12900	2650	6750	38450
		60-100	7.3	3.15	177.0	5200	12500	1200	5800	45230
		100-150	6.2	2.13	167.0	4350	12300	1250	7850	45100
	6	0-25	15.8	3.70	465.3	4356	16870	6570	9420	40200
		25-70	5.9	2.25	244,0	3915	15950	5100	9350	41600
		70-120	4.3	1.15	230.0	3370	14280	3357	8770	42300
	7	0-25	22.3	5.3	357	2250	13266	3350	4360	28300
		25-75	10.7	2.5	240	2810	12100	2230	3800	28800
		75-150	6.3	2.2	330	3150	11215	1140	3100	38107
Fluvio marine plaine	8	0-25	6.3	2.1	480	3080	8250	1130	3630	40650
		25-55	2.2	1.0	290	2670	7330	1050	3150	36960
		55-85	1.5	1.0	280	2410	5360	1010	3150	33450
		85-110	1.3	0.2	270	2315	4940	1000	2260	32655
	9	0-25	7.2	3.1	450	2680	13415	3250	5420	28415
		25-50	6.3	2.4	425	2110	13680	2330	4360	26860
		50-100	5.4	2.2	420	1251	12410	1640	3415	29680
		100-150	5.2	1.3	410	1630	11320	1460	160	26590
	10	0-25	22.1	12.3	340	3650	16560	3430	8640	37600
		25-75	15.1	3.8	320	3638	14460	2640	8430	37410
		75-150	7.6	3.2	315	3510	12620	1030	7932	38315
	11	0-25	21.1	8.2	440	3685	13530	2192	8424	32310
		25-65	13.3	6.2	410	2830	12510	2170	7580	38670
		65-150	10.1	2.5	380	2100	12270	2110	6850	38360

Relationship between some soil variables Fe fractions:

To evaluate the role of soil variables in affecting Fe fraction in the soils representing the studied soils, correlation were computed and recorded in Table (4). The data in Table (4) reveal that the amounts of Fe-oxides were negatively and highly significant correlated with coarse sand (r=0.782**), silt (r=-0.608**) and $CaCO_3$ content (r=-0.465**) and negatively significant correlated with pH (r=-0.381*).

The amounts of Fe-amor. Were negatively and highly significant correlated with coarse sand (r=-0.3542**) and $CaCO_3$ content (r=-0.522**), while it was positively highly significant correlated with silt content (r=0.587**).

Also, the amount of Fe-crystalline were positively highly significant correlated with silt content (r=0.499**) and negatively significant correlated with clay content (r=-0.322*).

The amounts of Fe in the sand fraction were positively significant correlated with silt content (r=0.369*) and negatively correlated with $CaCO_3$ (r=-0.396*), while the amounts of Fe in the silt fraction were positively significant correlated with fine sand content (r=0.382*)

With regard to the amounts of Fe in the clay fraction, data in Table (4) show that the amounts of Fe in the clay fraction were positively significant correlated with fine sand (r=0.496**), and OM content (r=0.344*) and negatively significant correlated with clay content (r=-0.393*), $CaCO_3$ content (r=-0.386*) and pH (r=-0.466**).

These results agree with obtained by El-Sayed (1988) and Abd El-Aziz et al. (2009).

Table (4): Correlation coefficients (r) between some soil constituents and Fe fractions in the studied soil profiles.

Soil variables	Exch.	O.M	Mn-oxides	Amo. Oxides	Crystalline iron oxides	Sand	Silt	clay
Coarse sand %	0.080	-0.171	-0.782**	-0.542**	-0.257	-0.211	.076	-0.273
Fine sand%	0.030	0.003	-0.174	-0.017	0.253	0.297	0.382*	0.496**
Silt %	-0.010	0.143	-0.608**	0.587**	0.400**	0.369*	0.009	0.299
Clay%	-0.050	-0.005	0.186	-0.044	-0.322*	-0.304	-0.297	-.353*
$CaCO_3$ %	-0.220	-0.185	-0.465**	-0.552**	-0.227	-0.396	-0.240	-0.386*
OM %	-0.083	-0.025	0.074	0.181	-0.021	0.218	0.206	0.344*
pH	-0.126	-0.303	-0.381*	-0.295	-0.199	-0.402	-0.003	-0.460**
ECe	0.092	0.031	0.212	o.028	-0.185	-0.006	-.166	0.08

Manganese fraction

Data presented in Table (5) reveal that the values of Exch-Mn and Mn bound by organic matter in the alluvial soils are ranging from 0.5 to 7.5 µg g^{-1} and 0.1 to 1.3 µg g^{-1}, respectively. In the fluvio marine soils, the content of Exch-Mn and Mn-bound by organic matter ranged between 0.6 and 5.4 µg g^{-1} and 0.1 to 2.4 µg g^{-1}, respectively. The highest values characterized the surface, layer of profile.11, while the lowest value is detected in the deepest layers of profile 8. Generally all the studied soil samples contain Mn organic matter relatively low in comparison Exch-Mn. Here, it is worth mention that the obtained data are in close agreement with those of Rashed et al (1995) and El-Toukhy et al. (2008).

With regard to the distribution of Mn element in Mn-oxides, Mn-amorphous and Mn-crystalline iron oxides in the Nile alluvial soils varied widely from 66.8 to 290.3 µg g^{-1} , 71.0 to 212.6 µg g^{-1} and from 28.4 to 162.1 µg g^{-1}, respectively. In the fluvio marine soils, the distribution and levels of Mn-element ranged from 110.2 – 280.4 µg g^{-1}, 35.7 – 160.8 µg g^{-1} and 28.6 – 118.8 µg g^{-1} in Mn-oxides, Mn-amorphous and Mn-crystalline, respectively. Generally, the values of Mn-oxides fraction are higher than those Mn in amorphous iron oxides and Mn-crystalline iron oxides fraction in all the studied soil profiles. Also, Mn fractions in the studied soils can be arranged in the order

Mn-oxides > Mn-amorphous iron oxides> Mn-crystalline iron oxides.

With respect to the distribution and levels of manganese in the soil fraction (sand, silt and clay). Data in Table (5) reveal that Mn values in the sand, silt and clay fractions in the Nile alluvial soils varied from 12.2 to 91.8 µg g^{-1}, 14.1 to 192.3 µg g^{-1} and 13.1 to 77.5 µg g^{-1}, respectively. The highest values are detected in the surface layer of profile 7, while the lowest values are associated with the deepest layers of profile 5.

In the fluvio marine soils, data in Table (5) show that the values of Mn ranged from 6.7 to 91.7 µg g^{-1} , 22.6 to 119.1 µg g^{-1} and 10.4 to 45.3 µg g^{-1} in the sand, silt and clay fractions, respectively.

It is clear that, Mn values in the silt fraction are relatively higher than those in the sand and clay fractions in most of the studied soil

profiles. The Mn fraction in the Nile alluvial and fluvio marine soils can be arranged in the order
Silt >sand > clay

Table (5): Manganese contents (µg/g soil) of eight fractions for the studied soil profiles

Phiso-graphic unit	Profile No.	Depth (cm)	Exch.	O.M	Mn-oxides	Amo. Oxides	Crystalline iron oxides	Sand	Silt	clay
Nile alluvial plain	1	0-20	1.3	0.1	260.1	200.3	162.1	.51.5	60.4	56.2
		20-55	0.5	0.3	267.8	210.1	153.1	41.3	55.6	46.9
		55-100	0.5	0.2	280.7	212.6	138.2	28.3	45.2	35.2
		100-150	1.1	0.2	290.3	199.6	115.1	18.6	35.3	28.3
	2	0-20	1.7	1.3	120.3	88.5	79.4	51.8	160.4	45.5
		20-50	1.5	1.1	115.6	81.3	73.8	61.5	145.5	26.1
		50-95	1.6	0.2	103.7	95.6	64.8	66.8	116.0	16.5
		95-150	7.5	0.1	66.8	71.0	62.8	55.0	119.0	14.7
	3	0-20	1.0	0.2	267.1	135.0	162.0	41.1	152.2	66l8
		20-60	1.3	0.3	198.5	130.6	148.0	51.8	160.8	51.2
		60-100	0.5	0.3	226.8	128.6	99.5	61.3	192.3	45.3
		100-150	1.6	0.1	190.6	111.2	95.9	60.	116.8	27.8
	4	0-25	1.4	1.1	220.3	135.0	62.1	51.8	70.4	36.3
		25-65	1.6	0.3	198.6	113.2	56.3	62.5	60.3	25.7
		65-100	1.0	0.1	226.8	129.5	33.5	50.3	60.1	16.3
		100-150	1.6	0.3	142.3	111.2	28.4	44.6	50.7	15.1
	5	0-20	1.6	0.3	186.2	151.8	62.3	18.8	40.3	51.1
		20-60	1.0	0.2	180.3	143.2	56.4	14.3	34.5	41.1
		60-100	1.3	1.2	190.6	128.3	46.3	12.2	24.3	36.2
		100-150	1.2	0.4	240.0	110.3	30.5	22.6	14.1	35.1
	6	0-25	2.0	0.3	255.3	129.5	59.6	60.7	80.5	36.7
		25-70	1.0	0.4	270.0	117.7	45.4	52.3	60.4	25.2
		70-120	1.8	0.3	260.7	110.1	33.3	41.4	50.3	13.1
	7	0-25	2.0	1.3	226.8	130.0	69.8	91.8	115.3	77.5
		25-75	2.1	0.6	190.6	133.2	59.7	71.3	101.7	75.3
		75-150	1.4	0.1	180.2	135.2	45.3	63.2	92.3	31.8
Fluvio marine plaine	8	0-25	1.3	0.5	171.3	81.5	48.3	41.1	50.1	13.8
		25-55	1.2	0.3	130.6	71.6	38.5	16.7	52.2	16.7
		55-85	0.6	0.1	120.3	51.3	36.1	18.8	29.5	14.8
		85-110	0.9	0.1	110.2	35.7	28.6	6.7	22.6	10.4
	9	0-25	1.8	0.8	280.3	140.6	99.8	55.6	70.1	41.3
		25-50	1.5	0.1	270.6	160.8	79.6	60.7	60.3	45.0
		50-100	2.1	1.1	260.3	151.3	69.1	63.2	55.8	33.8
		100-150	2.5	1.2	265.6	129.3	68.6	26.8	55.0	36.4
	10	0-25	2.6	1.3	280.4	153.1	114.6	61.3	70.3	36.7
		25-75	2.3	0.6	290.4	140.3	118.8	41.4	60.2	31.9
		75-150	2.5	0.3	298.4	135.6	11.4	41.1	51.3	26.8
	11	0-25	5.4	2.4	270.4	123.7	116.3	91.	116.8	45.3
		25-65	3.2	1.2	275.6	121.6	103.1	71.3	119.1	36.8
		65-150	3.5	2.1	256.4	129.4	101.2	62.4	92.2	28.4

Relationship between some soil properties and Mn fractions

Concerning the relationship between Mn fractions in the studied soil profile and some soil properties, it is clear from Table (6) that Exch-Mn was positively significant correlated with OM content (r=0.324*) and negatively highly significant correlated with pH (r=-0.444*). Also, a negatively highly significant correlated was found between Mn-oxides and clay content (r=-0.367*) and pH (r=-0.527**) and positively significant with silt content (r=0.354*).

Regarding the Mn-amorphous oxides, data in Table (6) revel that these was a negatively highly significant correlated between Mn-amorphous and fine sand (r=-0.386*), silt content (r = -0.406**) and positively significant correlated with clay content (r =0.471**) and OM content (r =0.363*).

A negatively high significant correlated is found between Mn-crystalline and coarse sand (r = -0.414**) and $CaCO_3$ (r = -0.735**) and positively highly significant correlated with OM content (r= 0.659**).

The amounts of Mn fraction were negatively highly significant correlated with coarse sand (r = -0.395*) and fine sand content (r = -0.458**) and positively highly significant correlated with clay content (r = 0.451**).

Table (6): Correlation coefficients (r) between some soil constituents and Mn fractions in the studied soil profiles.

Soil variables	Exch.	O.M	Mn-oxides	Amo. Oxides	Crystalline iron oxides	Sand	Silt	clay
Coarse sand %	-0.068	0.033	0.014	0.061	-.0414**	-0.259	-0.395*	-0.119
Fine sand%	0.090	-0.064	0.248	-0.386*	-0.243	-0.152	-0.468**	-0.678**
Silt %	0.014	-0.049	0.354*	-0.406**	-0.278	0.177	0.120	-0.546**
Clay%	-0.043	0.037	-0.367*	0.471**	0.205	0.166	0.451*	0.846**
$CaCO_3$ %	-0.300	-0.234	0.050	-0.0122	-.0735**	-0.290	-0.269	0.015
OM %	0.324*	0.267	-0.188	0.363*	0.659**	0.310	0.081	0.206
pH	-0.444**	-0.297	-0.527**	0.117	-0.028	-0.286	-0.150	0.483**
ECe	0.193	0.081	0.070	0.126	-0.032	-0.016	0.280	0.106

* = Significant at 5%level (=0.312)
** = Hghly significant at 1% level (r = 0.403)

Data in table (6) indicate that highly significant correlated with fine sand (r = -0.678**) and silt content (r= -0.546**) and positively highly significant correlated with clay content (r= 0.846**) and pH (r =0.483**). These results agree well with those obtained by El-Toukhy et al.(2008).

REFERENCES

Abd Alla, M.A.(2000). Statuse of some micronutrients in some soils of Egypt. M.Sc. Thesis, Thesis Fac. of Agric. Xagaxig Univ. (Benha Branch).

Abdel Aziz, W. H., M. A. AbdAlla. A. H. Hassanin and S. S. El-Sayied (2009). The chemical fractionation of soil iron in some Egyptian soils. J. Biol. Chem. Environ. SCi. vol 4(1):251-764

Aboulroos, S.A.; Sh. Sh. Hloh; M.L. El-Kherbawy and E. M. Badawy (1991). Fractionation of some hevey metals in soils irrigated with sewage effluents for different years. J. Soil Sci.:31(1):43-55

Ahumadam I. l Mendoza and L. Ascar (1999).sequential extraction of heavy metals in soils irrigated with westwater. Commun, Soil Sci. plant Anal. 30:1507- 1515[ISI].

Chao, T.T.(1972). Selective dissolution of manganese oxides hydroxylamine hydrochloride. Soil Sci. Am.Proc. 36: 764=768.

Chlopckam A. J. Bacanl; M. J. Wilsonm and J. Kay (1996). Forms of cadmium, lead, and zinc in soils from southwest Poland. J. Environ. Qual. 25:69-70[ISI]

El-Sayed, E. A. (1988). Satus of some trace elements in relation to nature of the main sediments in El=Fayoum depression. Ph.D.Thesis Dept. of Soil Sci. Univ. of Aberdeam, U.K.

El-Toukhy, M.M., S. El-Nagar; e. M. K. Bahiry and S. T. M. El-Shaboury (2008). The chemical fractionation of soil manganese in some alluvial and calcareous soils of Egypt. J. Appl.Sci., 23(3):351-366

Hegazy, M. A. El-Sayad and E. A. Sorour (1991). Evaluation of some extract for determining available Fe, Mn, and Cu in some Egyptian soils. Zagazig J. Agric. Res. 18(3): 897-910

Kabata-Pendiasm A. and Pendias (1992). Trace-element in soils and plants 2nd ed CRC press. Boca Ratonm FL.

Kasaweuthm F.E. (1971). Solution activity and plant growth. Soil Sci. Soc. Amerproc., 35:426-428

Kennedy, V. H., A. L. Sanchemy, D.H. Oughton and A.P. Rowiland (1997).Use of single and sequential chemical extractantsm to assess raduionclide and heavy metal availability from soils for root uptake. Analyst 122:89-100[ISSI]

Kuo, S.; P.E.Heilman and A.S. Baker(1983). Distribution, iron and manganese in soils near a copper smelter. Soil Sci, 135:101-109.

Lyengar, S.S.; d.C. Marteus and W.P. Miller(1981). Distribution and plant availability of soil xinc fraction. Soil sci. Soc. Am.J.45:739-739

Ma, Q. and G. N. Rao (1997). Chemical fractionation of cadmium , coper, nickel and zinc in contaminated soils. J. Environ., Qual.26: 259-264[ISI]

Norvell, W.A. (1988). Inorganic reactions of manganese in soils. P. 37-58. in R.D.Graham et al. (ed) Manganese in sil and plant. Kluwer Acad. Publ. Dordrecht. The Netherlands.

Page, A.L.; R.M. Milner and D.R.Kenney (1982). Methods of Soil Analysis/ part2 " Chemical and microbiological properties" 2nd edition Amer Soc. Of Agronomy Series Madison Wisconsion

Pickering, W. F. (1986). Metal ion speciation-soils and sediments (a reviw) Ore. Geol. Rev. 1:83-146

Rabie, E., T.F.Rashad, M.Y.Khader and W. Hussein (1996). Content of biogenic and non biogenic heavy metals in El-Saff as related to different pollution sources. Egypt. J. Soil Sci.36:165-177

Rashad, I.F., A.O.Abdel Nab, M. E. El-Hemely and M.A. Khalf(1995). Background levels of heavy metals in the Nile Delta soils. Egypt J. Soil sci. 35:239-252

Sherman, A. D. (1957). Soil- The year Book of Agriculture, U.S.D.A.

Shuman, L. M. (1985). Fractional methods for soil micro-elements Soil Sci.140;11.

Shuman, L. M.(1979). Zinc, Manganese and copper in soil fractions. Soi Sci., 127:10-17

Singh, B.R.(1997). Soil pollution and contamination p. 279-299. In r. Lal(ed) Methods for assessment of soil degradation. CRC pres Boca Roton, FL.

Snedecor, G. W. and W. G. Cochran (1967). Statistical Methods, 6th Eude.Iowa State Univ. Press, Ames.

Sposito, L.J.Lund and A.C.Chang(1982). Trace metal chemistry in arid xone field soils amended with sewage sludge,1- fractionation of Ni, xn, Cd and Pb in sold phase. Soil Sci. Am.J.46, 260

تصنيف وتوزيع للحديد والمنجنيز فى بعض الاراضى المصرية

سامى عبد الجيد عبد اللة – نادية عبد العظيم محمد – سامى عبد الحكيم الشيخة
معهد بحوث الاراضى والمياه والبيئة – مركز البحوث الزراعية – جيزة

اختير عدد 11 قطاع ارضى لتمثل الاراضى الرسوبية النهرية والاراضى البحرية النهرية لدراسة التوزيع الكيميائى لكلا من عنصرى الحديد والمنجنيز وكذلك تم تقدير الخواص الطبيعية والكميائية لهذه الاراضى مثل pH,EC ، نسبة كربونات الكالسيوم نسبة المادة العضوية وكذلك قوام التربة واجرى التحليل الاحصائى بغرض ايجاد العلاقة بين متغيرات التربة والصور المختلفة للحديد والمنجنيز فى الاراضى تحت الدراسة.

وتشير نتائج الدراسة الى أن تركيز الحديد المتبادل والمرتبط بالمادة العضويه والموجودة فى صور اكاسيد وصور امورفية وحديد فى الاكاسيد المتبللورة وفى الرمل والسلت والطين تتراوح ما بين 3.3 لاى 24.8، 1.15 لاى 17.8، 75الى 480، 1900 الى 7700 ، 10300 الى 16900، 230 الى 6570، 1388 الى 9420 و 28300 الى 45280 ملليجرام/جرام على الترتيب وذلك فى الاراضى الرسوبية النهرية أما فى الاراضى البحرية النهرية فقد تراوحت هذه التركيزات ما بين 1.3 الى 22.1، 0.2 الى 12.3، 270 الى 480، 1251 الى 3685، 11320 الى 16560، 1000 الى 3430و 2160 الى 8640، 26590 الى 40650 ملليجرام/جرام على الترتيب.

وكذلك فقد وجد أن الاراضى تحت الدراسة تحتوى على تركيز عالى من الحديد فى الطين المفصول وأقل تركيز وجد فى الرمل وقد تبين من توزيع الصور المختلفة للحديد فى الاراضى تحت الدراسة فقد أخذت الترتيب التالى:

حديد (طين) > حديد (أكاسيد متبللوره) > حديد (سلت)> حديد (فى صورة امورفية)> حديد (رمل)> حديد (أكاسيد)>(حديد متبادل) > حديد مرتبط بالمادة العضوية

وبالنظر الى توزيع عنصر المنجنيز فى الاراضى تحت الدراسة تشير النتائج الى أن المنجنيز متبادل ومرتبط بالمادة العضوية مرتبط مع الاكاسيد ومنجنيز فى صورة امورفية منجنيز فى صورة متبلورة وفى أحجام حبيبات التربة الرمل والسلت والطين تراوحت فى الاراضى الرسوبية النهرية ما بين (0.5 - 7.5)، (0.1-1.3)، (66.8-295.3)، (71.6-212.6)،(28.4-162.1)، (12.2-91.8)،(14.1-192.3)، (13.1-77.5ملليجرام/جرام) على الترتيب.

وفى الارضى البحرية النهرية فقد تراوح تركيز المنجنيز ما بين 0.6 الى 5.4، 0.1الى 2.4، 110.2 الى 280.4 ، 35.7الى 160.7، 28.6 الى 118.8، 6.7 الى 91.7 ، 22.6 الى 119.1، 10.4 الى 45.3 ملليجرام/جم على الترتيب.

وتوزيع المنجنيز فى الاراضى تحت الدراسة أخذ الترتيب التالى:

منجنيز (أكاسيد)> منجنيز (امورفى)> منجنيز (متبللور)> سلت>رمل>طين>منجنيز متبادل> منجنيز مرتبط بمادة عضوية

وقد اجريت عملية التحليل الاحصائى لتحديد مدى الارتباط بين الصور المختلفة لعنصرى الحديد والمنجنيز وبعض متغيرات التربة.