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EFFECT OF AUTOMOBILE EMISSIONS ON THE CONTAMINATION WITH LEAD AND CADMIUM OF SOILS AND PLANTS IN SOME SOILS OF EGYPT.

Husein, M. E. and M. M. Kamel
Soils Dep., Fac. of Agric., Cairo Univ., Egypt

ABSTRACT

The present work aims to study the effect of automobile exhaust on the contamination of soils and plants with lead and cadmium. Twenty four surface soil samples (0-30cm) were collected from different locations at the distance 5,100 and 200 meters cultivated with clover plants along the Cairo-Damietta main road.

The total content and DTPA-extractable Pb and Cd were assessed. Cadmium and Lead content in the soils, decreased as affected by the distance from the pavement. The highest concentrations of Pb and Cd were found in soils near the road and the lowest at a distance 200m far from the road.

The content of lead in clover plants showed the same trend as soil samples, this effect was clear on plants till 168 m distance. The data indicate that automobile exhaust was the main effect of plant and soil contamination with lead, while the automobile exhaust was not responsible for soil and plant contamination with cadmium.

Keywords: automobile emissions, cadmium, lead, contamination, clover plant

INTRODUCTION

Roadside soils usually contain high concentrations of metallic contamination. The bioavailability and environmental mobility of the metals depended upon the form in which the metal is associated with the soil. Lead street dust and roadside soil has been extensively studied, and found to be present at elevated levels. (Ho and Tai, 1988)

Automobile emissions are considered as a significant source of Pb pollutants, the urban soils were heavily polluted by Pb from gasoline combustion (Chen *et al.*, 1997and Imperato *et al.*, 2003). Singer and Hanson (1969) reported that the soils behind highways in the U.S.A. had lead accumulation related to traffic volume and distance from the highways.

Aibasel and Cottenie (1985) reported that soil contamination by Zn and Pb was quite pronounced along highways and in some case contamination by Mn was also obsarved. Contamination by these heavy metals decreased rapidly with increasing ditance from the highway. High values of metal accumulation in plants located near highways were obseved.

Igwegbe *et al.*, (1992) found that the statistical analyses of the major road contributed significantly ($P < 0.05$) to higher concentrations of lead in all the crops examined; and also cadmium in all the crops except in potatoes. Vegetable crops were found to have higher contents of these two metals than the fruits. Substantial amounts of these metals could be removed by washing the samples with triple distilled water.

Singh *et al.*, (1997) found that changing levels of lead (Pb) in the soil and vegetation along two National Highways at India. Thy added that there was decrease in concentration with increasing distances from the road margins. Parkpien *et al.*, (2003) concluded that plants grown nearer to the highway are usually exposed to more heavy metal accumulation than those away from the highway. Olivares (2003) showed that the concentration of Pb in leaves and roots of plant samples at a heavy traffic roadside was higher than in samples from a light traffic site.

Lu *et al.*, (2005) reported that the average contents of Cu, Cd, Pb in automobile emission particulates were 95.83, 22.14 and 30.58 mg/kg, respectively. Turer (2005) reported that soils along highway environments typically contain high concentrations of heavy metals because of non-poinet contamination source, most commonly vehicle exhaust and wear of vehicle parts.

During the last few years, the number of vehicles in Egypt, mostly operated by leaded fuel, has increased rapidly leading to increase high levels of some heavy metals and other pollutants in the dust, soil and plants near highways in both rural and urban areas. El-Sherif and Yousry (1978) concluded that the content of lead in clover plants was found to increase with adjoining the plant sample to the main road. The Pb pollution is still perceptible even as 100 m of the main road. El-Desouky *et al.*, (1998) reported that the available and total content of Pb and Cd in the studied soils along the main roads inside El-Sharkiya Governorate changes regularly as a function of the distance from the pavement. Also , the concentration of Pb and Cd in clover plants follow the same trend previously obtained in soils with respect to the distance from the main roads.

The present study is initiated to assess the contamination levels of the roadside soils and so plants by cadmium and lead along Cairo- Damietta road.

MATERIALS AND METHODS

1-Sampling soils and plants:

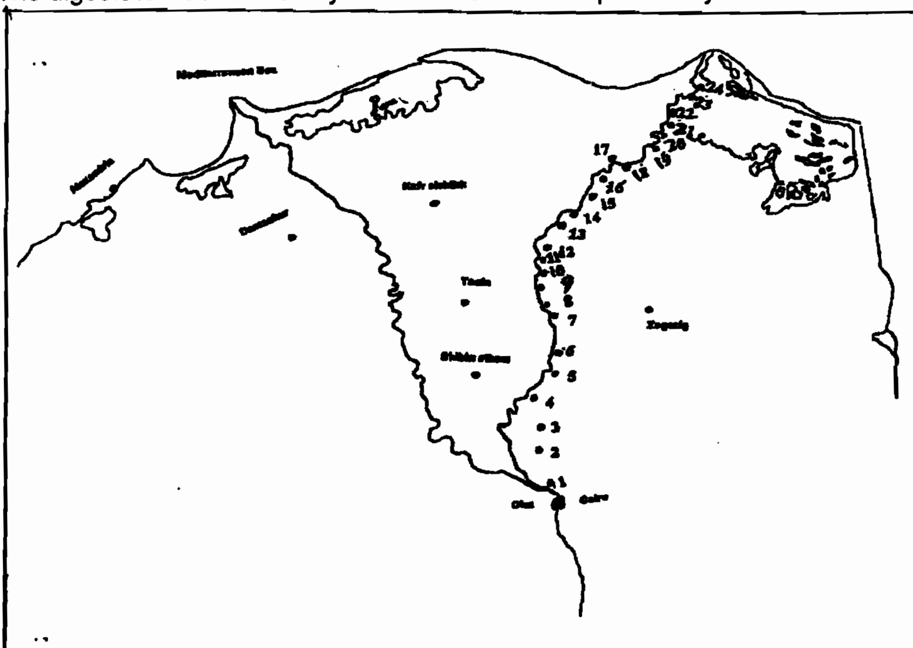
Twenty four locations cultivated with clover *"Trifolium alexandrinum"* were chosen at the eastern side along the Cairo- Damietta road (Fig.1). Three surface soil samples (0-30 cm) were collected from each location at distances; 5, 100 and 200 meters from the main road.

2-Soil analysis:

The collected soil samples were air dried and sieved to pass through a 2mm sieve. Mechanical analysis was performed according to the pipette method as described by Dewis and Feritas (1970). Organic matter content was determined by oxidation with dichromate method according to Walkley and Black, total carbonates were determined using Collins calcimeter (Dewis and Feritas, 1970). Soil pH was measured in 1:2.5 soil: water suspension using glass electrode. The electrical conductivity (EC) was measured in 1:2.5 soil : water extract. The total Pb and Cd were determined after fusion with mixture of concentrated HNO_3, $HClO_4$ and H_2SO_4 (Hesse, 1971). The available lead and cadmium were extracted using DTPA method (Lindsay and Norvell, 1978). Lead and cadmium were measured using Atomic absorption spectrophotometer.

3- Plant analysis;

The plants were cut at 1cm above the soil surface and rinsed once with diluted HCl and twice with distilled water, dried at 70 °C to constant weight, ground in porcelain mortar, and perceived for analysis. One-half gram sample of plant material was digested using concentrated H_2SO_4 and H_2O_2. The digestate was then analyzed for Pb and Cd as previously mentioned.



1- Shobra al-khema	7- Sahragt El-Kobraa	13- Nawassa El-Bahr	19- Elzarkaa
2- Kaluob	8- Meet Ghamer	14- Mansoura	20- Elsero
3- Kaha	9- Beshla	15- El-Khelareiah	21- Dakahla
4- Toukh	10- Feshah	16- Badaway	22- Faraskour
5- Banha	11- Tonamel	17- Sherbeen	23- El-shoarae
6- Kafr Shukr	12- Agaa	18- Mehallet Engaak	24- Meniet Demietta

Fig .1. Locations of the collected soil and plant samples.

DISCUSSION

Some physical and chemical properties of the studied soils at the 5 meters from the main road are shown in table (1).The soils ranged In their clay content from 23.69 to 57.12%, pH (1:2.5 soil-water suspension) from 7.7 to 7.9 , EC from 0.22 to 6.31dSm^{-1} , organic matter content from 0.18 to 1.52 % and calcium carbonate content from 0.50 to 4.13%.

Table (1): Some initial soil physical and chemical properties of the studied locations.

No.	Location	Particle size distribution				Texture	pH	E.C	O.M%	$CaCO_3$%
		c.s %	f.s %	silt %	clay %					
1	Sobra al-khema	10.31	18.44	26.99	44.26	C	7.7	0.22	0.84	3.52
2	Kaluob	13.32	13.52	25.17	47.99	C	7.9	0.53	1.15	3.61
3	Kaha	6.74	18.32	40.93	34.01	C.L	7.7	0.37	0.34	4.10
4	Toukh	10.41	12.41	27.53	49.65	C	7.7	0.62	1.52	3.10
5	Banha	5.88	10.93	26.07	57.12	C	7.9	0.27	0.94	2.91
6	Kafr Shukr	10.22	16.58	27.33	45.87	C	7.9	0.83	0.77	2.70
7	Sahragt El-Kobraa	7.14	17.48	40.4	34.98	C.L	7.9	0.22	0.27	0.50
8	Meet Ghamer	8.89	10.98	28.8	51.33	C	7.8	0.71	0.77	1.50
9	Beshla	11.56	12.25	27.63	48.56	C	7.8	0.68	1.32	2.0
10	Feshah	10.69	17.62	26.55	45.14	C	7.9	0.24	1.15	0.55
11	Tonamel	11.1	12.57	20.22	56.11	C	7.8	0.33	0.53	0.90
12	Agaa	11.31	16.24	27.24	45.21	C	7.9	0.41	0.66	3.20
13	Nawassa El- Bahr	5.38	20.27	29.73	44.62	C	7.9	0.77	0.53	1.10
14	Mansoura	9.79	17.18	26.68	46.35	C	7.7	0.44	1.30	2.30
15	El-Kheiareiah	8.5	19.79	27.6	44.11	C	7.8	0.22	0.98	4.13
16	Badaway	10.15	18.29	25.84	45.72	C	7.8	0.51	0.53	3.20
17	Sherbeen	9.55	14.89	24.58	50.98	C	7.8	0.44	0.77	2.61
18	Mehallet Engaak	6.54	18.52	41.11	33.83	C.L	7.9	0.44	0.44	2.50
19	Elzarkaa	13.78	13.46	24.88	47.88	C	7.9	0.79	1.10	2.90
20	Elsero	10.42	18.11	26.83	44.64	C	7.8	0.95	0.71	3.70
21	Dakahla	6.76	18.52	40.82	33.9	C.L	7.8	1.89	0.39	1.20
22	Faraskour	12.02	24.67	32.1	31.21	C.L	7.8	3.72	0.29	2.10
23	El-shoarae	15.55	36.52	20.99	26.94	S.C.L	7.9	5.40	0.19	1.20
24	Meniet Demietta	15.8	38.3	22.21	23.69	S.C.L	7.8	6.31	0.18	0.90

Data in table (2) showed that the concentrations of total and DTPA-extractable Pb and Cd (µg/g) in the soils along the inside main road Cairo-Damietta changes regularly as a function of the distance from the pavement. The highest value was noted in the soil directly closed to the road and the lowest was in soil at 200m far from the road. This may indicate that air pollution due to automobile exhausts is considered to the main source of available Pb and Cd in the cultivated soils. However, Jaradat and Momani (1999) reported that the Cu, Cd, Pb and Zn pollution is still perceptible even as far as 60m of the main highway connecting Amman. In Egypt, El-Sherif and Yousry (1978) reported that the Pb pollution is still perceptible even as – far as 100m of the main Cairo – Alexandria agricultural road.

The total content of Pb and Cd in the studied soils ranged between 6.40-33.20 and 0.97-3.71 µg/g soil, respectively. The high contents of total Pb were observed in the soil of kafr shuker location. These values are higher than the range (1.7 – 5.4 µg/g) found by Aboulroos *et al.*, (1996) for unpolluted cultivated soils at Egypt. The higher values of total Cd were observed in the soil of Meet Ghamer location. These values are higher than the range (0.017-0.095 µg/g) reported by Aboulroos *et al.*, (1996) for unpolluted cultivated soils at Egypt.

The DTPA-extractable amounts of Pb and Cd in soils are also given in table (2). Most of the studied soils contain 1.73 - 6.92 µg/g DTPA- extractable Pb and 0.01-0.28 µg/g DTPA- extractable Cd. These values are higher than the range (0.51-2.88 µg/g and nel -0.06 µg/g DTPA-extractable Pb and Cd, respectively founded by Aboulrous *et al.*, (1996) for unpolluted cultivated soils at Egypt.

No significant correlation have been obtained between either the DTPA-extractable values of Pb or Cd and the total content of these elements in the studied soils(r = 0.141,and r = 0.150, respectively). This may be supported by the finding of Obukhov and Lepneva,(1990) who stated that most of the heavy metals center city atmosphere with industrial and automobile emission are not readily soluble compounds (oxides and sulfides).

Data in table (3) show that the lead and cadmium content in clover plants which collected from the studied locations ranged from 3.2 to 29.7µg Pb/g dry weight and 0.11 to 1.77µg Cd/g dry weight. Values reveal that clover plants which grow adjacent to the main road showed contents of lead and cadmium higher than those away from the road. Jaradat and Momani (1999) reported that the levels of heavy metal contamination in both surface soils and vegetation, exponentially decreased to background levels with distance on either side of the highway. The decrease of elemental concentration with distance from the highway would indicate aerial deposition of metal particulates in the roadside environment from extraneous sources and not a function of soil type.

Table (2): DTPA–extractable values and total contents of lead and cadmium in soils as influenced by distance from the main road.

No.	Location	Distance from the main road	Pb (µg/g)		Cd (µg/g)	
			T.	Av.	T.	Av.
1	Shobra al-khema	5	17.10	3.21	3.41	0.18
		100	16.20	3.11	3.20	0.15
		200	10.70	2.95	3.04	0.10
2	Kaluob	5	27.8	5.73	3.60	0.27
		100	26.3	5.43	2.7	0.22
		200	25.7	5.11	2.02	0.17
3	Kaha	5	25.2	4.83	2.42	0.16
		100	24.6	4.67	1.80	0.14
		200	23.10	4.55	1.70	0.13
4	Toukh	5	28.10	3.23	2.54	0.21
		100	27.60	2.98	2.20	0.19
		200	26.20	2.43	1.80	0.16
5	Banha	5	12.40	2.91	2.30	0.18
		100	11.80	1.82	1.44	0.17
		200	10.60	1.73	1.00	0.16
6	Kafr Shukr	5	33.20	3.37	1.63	0.28
		100	29.60	2.89	1.66	0.26
		200	27.20	2.21	1.65	0.14
7	Sahragt El-Kobraa	5	12.2	3.31	3.36	0.22
		100	14.00	3.10	2.91	0.17
		200	12.60	2.92	2.83	0.11
8	Meet Ghamer	5	21.60	6.92	3.71	0.19
		100	20.20	5.99	2.03	0.16
		200	16.00	5.01	1.65	0.12
9	Beshla	5	12.00	2.23	3.63	0.22
		100	11.40	2.01	3.65	0.11
		200	10.00	1.86	2.87	0.03
10	Feshah	5	32.40	3.33	2.83	0.23
		100	30.00	2.72	2.01	0.19
		200	29.40	2.01	1.33	0.08
11	Tonamel	5	16.00	5.43	3.41	0.22
		100	15.10	4.82	3.22	0.16
		200	14.60	4.21	2.01	0.13
12	Agaa	5	17.10	2.91	2.84	0.28
		100	16.40	2.50	2.40	0.26
		200	15.30	2.07	1.93	0.17

Table (2): (cont.)

No.	Location	Distance from the main road	Pb (µg/g)		Cd (µg/g)	
			T.	Av.	T.	Av.
13	Nawassa El-Bahr	5	15.2	5.82	2.50	0.22
		100	13.6	5.53	2.33	0.18
		200	12.2	4.22	1.81	0.14
14	Mansoura	5	32.10	3.61	3.52	0.07
		100	31.40	3.56	3.31	0.03
		200	30.80	3.10	2.59	0.01
15	El-Kheiareiah	5	16.0	5.63	2.22	0.22
		100	15.40	[illegible].32	1.55	0.17
		200	14.7	3.11	0.91	0.12
16	Badaway	5	22.6	4.31	3.04	0.17
		100	21.10	3.84	3.51	0.10
		200	20.30	3.72	2.33	0.10
17	Sherbeen	5	33.0	5.43	2.00	0.22
		100	32:10	5.11	1.61	0.21
		200	32.3	4.62	1.52	0.10
18	Mehallet Engaak	5	30.6	5.91	2.11	0.12
		100	29.5	5.43	2.13	0.11
		200	28.2	3.11	1.45	0.03
19	Elzarkaa	5	16.3	4.76	2.42	0.22
		100	15.4	4.22	1.83	0.18
		200	10.5	3.98	1.52	0.09
20	Elsero	5	33.10	5.51	1.55	0.22
		100	30.20	5.42	1.32	0.19
		200	30.50	4.11	1.11	0.12
21	Dakahla	5	22.40	3.91	2.22	0.22
		100	21.3	3.54	1.53	0.16
		200	19.8	3.37	1.21	0.04
22	Faraskour	5	26.10	3.37	2.32	0.10
		100	25.4	3.10	1.76	0.08
		200	24.5	2.76	1.93	0.07
23	El-shoarae	5	9.2	5.64	2.11	0.17
		100	8.3	5.61	1.76	0.16
		200	7.0	4.31	1.22	0.09
24	Meniet Demietta	5	7.0	4.22	1.53	0.18
		100	7.0	4.10	1.41	0.16
		200	6.4	3.07	0.97	0.08

Kabata-pendias and Pendias, (1992) reported that the critical level of Pb and Cd which cause plant toxicity is 10 and 3ug/g dry matter, respectively. According to the present data, the content of Pb in plant samples which taken from 5m far from the main road were higher than the recommended critical levels, the most plant samples which collected from 100m of the main road were also higher than the recommended critical levels. The plant samples which collected from 200m far of the main road were lower than recommended critical levels of lead in plants.

The correlation obtained for the quadratic relationship between Pb content in plants and distance is as follows:

$$\text{Pb – plant} = 33.62 - 0.292X + 0.00087X^2, [1]$$

Differential's method of quadratic regression (equation [1] was used to find the predicted critical distance. The differential quadratic regression (equation [1] is as follows:

$$dy/dx = -0.292+0.00174X$$

So, the value for critical distance is 167.8m, increasing of this distance addition the Pb plant will decline.

According to the critical distance which obtained from the previous equation, its important to wash the clover plants which grow in the soil of this critical distance before animal feeding. Igwegbe *et al.*, (1992) reported that the lead contamination of plants which grow through 100m of the main road can be reduced by washing these plants with water. Jaradat *et al.*, (2005) concluded that there was a significant difference in heavy metal concentration between washed and unwashed plant samples. Momani *et al.*, (2002) concluded that a significant differences in levels of heavy metal content between washed and unwashed plants was observed.

There was no significant correlation between available and plant content of Pb (r = 0.232). It can be attributed to the adsorption of Pb by plant leafs. Singh *et al.*, (2004) reported that a possible correlation between lead concentration in air and lead accumulation in the foliage of avenue trees, lead in leaves were found to be positively correlated with Pb pollution in the air.

The content of cadmium in all plant samples at all locations were less than the recommended critical levels of cadmium which cause toxicity in plant. Highly significant correlation coefficient between available and plant content of Cd($r = 0.705^{88}$), it may be attributed to the phosphorous fertilization as super phosphate which contain Cd at least 18.2-28.5 ug/g (Srikant *et al.*, 1994). Also, Chien *et al.*, 2003) concluded that a single superphosphate (SSP) contain 32 mg Cd/kg.

Table (3): Total content of lead and cadmium in clover plants as influenced by distance from the main road.

No.	Location	Distance from the main road	Pb (ug/g dry matter)	Cd (ug/g dry matter)
1	Shobra al-khema	5	28.50	1.33
		100	17.30	1.03
		200	6.90	0.81
2	Kaluob	5	26.30	1.43
		100	14.10	1.04
		200	9.80	0.63
3	Kaha	5	28.60	1.21
		100	12.70	0.93
		200	7.90	0.21
4	Toukh	5	23.10	1.54
		100	9.70	1.40
		200	7.60	0.75
5	Banha	5	25.50	1.40
		100	11.60	1.33
		200	7.40	0.49
6	Kafr Shukr	5	29.70	1.55
		100	18.40	1.45
		200	16.30	0.76
7	Sahragt El-Kobraa	5	26.10	1.75
		100	15.50	1.26
		200	7.30	0.47
8	Meet Ghamer	5	22.40	1.76
		100	11.90	1.33
		200	7.60	0.52
9	Beshla	5	24.70	0.93
		100	13.60	0.55
		200	6.80	0.21
10	Feshah	5	15.50	1.53
		100	11.20	1.42
		200	5.40	0.65
11	Tonamel	5	27.60	1.62
		100	11.70	1.31
		200	6.20	0.39
12	Agaa	5	27.20	1.48
		100	14.10	1.40
		200	8.20	0.35

Table (3): (cont.)

No.	Location	Distance from the main road	Pb (ug/g dry matter)	Cd (ug/g dry matter)
13	Nawassa El-Bahr	5	25.20	1.27
		100	11.60	1.11
		200	7.70	0.23
14	Mansoura	5	23.10	0.99
		100	12.20	0.74
		200	5.60	0.11
15	El-Kheiareiah	5	22.20	1.57
		100	9.70	1.00
		200	3.20	0.39
16	Badaway	5	23.80	1.38
		100	17.60	1.11
		200	9.80	0.43
17	Sherbeen	5	25.50	1.11
		100	15.70	1.62
		200	7.70	0.53
18	Mehallet Engaak	5	27.30	1.45
		100	13.30	1.23
		200	6.80	0.41
19	Elzarkaa	5	22.70	1.77
		100	18.10	1.01
		200	8.50	0.56
20	Elsero	5	17.20	1.38
		100	9.30	1.09
		200	6.10	0.64
21	Dakahla	5	28.70	1.47
		100	16.90	1.16
		200	9.30	0.11
22	Faraskour	5	18.20	1.22
		100	13.10	0.69
		200	7.90	0.45
23	El-shoarae	5	17.90	0.48
		100	11.30	0.32
		200	5.90	0.11
24	Meniet Demietta	5	15.40	0.43
		100	10.10	0.31
		200	7.20	0.19

CONCLUSION

In Egypt, motor vehicles that burn leaded gasoline are mostly responsible for the build up of heavy metals in solid and in grasses along the highway through the emission of particulates. The roadside environment had a significantly high content of heavy metals, especially lead , and generally their levels increased with increasing traffic volumes and become elevated in the urban areas. The available and total content of lead and cadmium in the studied soils along the main road of Cairo – Demietta changes regularly as a function of the distance from the pavement. Also, the concentration of Pb in clover plants followed the same trend previously obtained in soils with respect to the distance from the main road. However, the extracted data of the present work may clear the importance of more intensive research work in order to give more information about the degree and role of heavy metals pollution in soil and plants under the Egyptian highways roads conditions.

REFERENCES

Aboulroos, S.A.; Sh. Holah and S.H. Badawy (1996). Background levels of some heavy metals in soils and corn in Egypt. Egyp. J. Soil Sci., 36:83-97.

Aibasel, N. and A. Cottenie (1985). Heavy metal contamination near major highways, industrial and urban areas in Belgian grassland. J. Water, Air and Soil Pollut.,24:103-109.

Chen, T.B.; J.W. Wong; H.Y. Zhou and H.Y. Wong (1997). Assessment of trace metal distribution and contamination in surface soils of Hong Kong. Environ. Pollut. , 96:61–68.

Chien, S.H.; G. Carmona; L.I. Prochnow and A.R. Austin (2003). Cadmium availability from granulated and bulk-blinded phosphate-potassium fertilizers. J. Environ Qual.,32:1911-1914.

Dewis, J. and F. Feritas (1970). Physical and chemical methods of soil and water analysis. FAO, Roma. Soil bulletin.No.10.

El-Desouky, H.I.; K.F. Moussa and H.H. Hassona (1998). Impact of automobile exhaust oadside soils and plants in Sharkiya Governorate. Egypt. J. Soil Sci., 38:137-151.

El-Sherif, A.F. and M.Yousry (1978). Lead content of clover plants and its relation to other micronutrients. Egypt J. Soil Sci., 18: 151-157.

Hesse, P.R. (1971). A Text Book in Soil Chemical Analysis. William Glowe, Londen.

Ho, Y.B. and K.M. Tai (1988). Elevated levels of lead and other metals in roadside soil and grass and their use to monitor aerial metal positions in Hong Kong. Environ. Pollut., 49:37- 51.

Igwegbe, A.O.; H.M. Belhag; T.M. Hassan and A.S. Gibali (1992). Effect of a highway traffic on the level of lead and cadmium in fruits and vegetables grown along the roadsids. J. of Food Safety, 13 :7–18.

Imperato, M.; P. Adamo; D. Naimo; M. Arienzo ;D. Stanzione and P. Violante(2003).Spatial distribution of heavy metals in urban soils of Naples city (Italy). Environ. Pollut.,. 124:247–256.

Jaradat,Q.M. and K.A.Momani (1999). Contamination of road side soil, plants and air with heavy metals in Jordan, a comparative study. Turk. J. Chem.,23:209-220.

Jaradat,Q.M.; A.Masadeh; M.A. Zaitoun and B. M. Maitah (2005). Heavy metal contamination of soil, plant and air of Scrapyard of Discarded Vehicles at Zarka City, Jurdan Soil and Sedim. Contamin., 14:449-462.

Kabata-Pendias, A. and H. Pendias (1992). Trace Elements in Soils and Plants. CRC press, Boca Raton, Ann. Arbor, London.

Lindsay,W.L. and W.A. Norvell (1978). Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. Amer. J., 42: 421-428.

Lu,S.G.;S.Q. Bai ; J.B. Sai and C. Xu (2005). Magnetic properties and heavy metal contents of automobile emission particulates. J. Zhejiang univ. Sci.,6:731-735.

Momani,K.A.; Q.M.Jaradat; A.Q.Jbarab; A.A.Omari and I.F.Al-Momani (2002). Water-soluble species and heavy metal contamination of the petroleum refinery area, Jordan J.Environ Monit., 4: 990-996.

Obukhov,A.I. and O.M. Lepneva (1990). Biochemistry of heavy metals in an urban environment. Sov. Soil Sci., New Yourk, Scripta Technica., 22:44-48.

Olivares,E. (2003). The effect of lead on the photochemistry of Tithonia diversifolia exposed to roadside automotive pollution or grown in pots of lead supplemented soil. Braz. J. Plant Physiol.,15:149-158.

Parkpien,P.; S.T. Leong; P.Laortanakul and N. Thunthaisong (2003). Regional monitoring of lead and cadmium contamination in a tropical grazing land site, Thailand. Eniviron. Mont. and Assess., 85:157-173.

Singr, M. L. and L. Hanson (1969). Lead accumulation in soils near highways in the twin sites Metropolitan area. Soil Sci. Soc. Amer. Proc., 33:152-156.

Singh, N.; M. Yunus; K. Srivestava; S.N. Singh; V. Pandey; J. Misra and K. J. Ahmed (2004). Monitoring of auto exhaust pollution by roadside plants. Environ. Monit. And Assess. 34:13-25.

Singh, R.P.; R.D. Tripathi; S.K. Sinha; R. Maheshwari and H.S. Srivastava (1997). Response of higher plants to lead contaminated environment. Chemosphere, 34:2467-2493.

Srikant, R.; Vasant Rao and N. B. Venugopal (1994). The effects of application of phosphatic fertilizer on cadmium concentration in ground water around Vineyards of Hyderabad. J. Environ. Mont. And Assess., 12:71-74.

Turer, D. (2005). Effect of non-vehicular sources on heavy metal concentrations of roadside soils. J. Water, Air and Soil Pollut.,166:251-264.

تأثير عوادم السيارات علي تلوث الأرض والنبات بالرصاص والكادميوم في بعض الأراضي المصرية

محمد الشربيني حسين و محمد محمد كامل
قسم الأراضي – كلية الزراعة – جامعة القاهرة

جمعت عينات تربة سطحية (صفر – ٣٠ سم) من ٢٤ موقع لحقول منزرعة بنبات البرسيم علي طول طريق القاهرة – دمياط الزراعي وذلك علي مسافات ٥ – ١٠٠ – ٢٠٠ متر من الطريق وكذلك أخذت عينات من نباتات البرسيم المزروعة فى نفس المواقع المدروسة وذلك بغرض دراسة اثر عوادم السيارات المارة بالطريق علي تلوث كل من التربة والنبات بكل من فلزى الرصاص والكادميوم.

وقد أظهرت النتائج المتحصل عليها أن أعلي تركيز من الرصاص والكادميوم في التربة كان في المواقع الملاصقة للطريق مباشرة . ثم ينقص التركيز تدريجيا كلما ابتعدنا عن الطريق حتى مسافة ٢٠٠ متر .كما أظهرت النتائج أن محتوى نبات البرسيم من الرصاص سلك نفس سلوك التى سلكته عينات التربة وكان تأثير التلوث بالرصاص واضحا على النبات حتى مسافة ١٦٨ متر من الطريق.

ولقد بينت الدراسة أن عوادم السيارات كانت السبب الرئيسى لتلوث التربة و النبات بالرصاص بينما لم تكن عوادم السيارات هى السبب فى تلوث التربة بالكادميوم و تراكم الكادميوم داخل النبات.