Investigating for Pb , Cd and Cu present in dust of Basrah city Roads.

Hussein. H. H
Dept. of Pharm .Chem., College of Pharmacy, Univ. Basrah

ABSTRACT

This research study examine streets dust pollution in Basrah city by heavy metals Pb, Cd, and Cu in this study it has been taking 100 dust specimen .50 from North Basrah and 50 from South Basrah including crowded general streets, bystreets, and from some street nearer to main Stations generators and from some housetops or terraces and gardens of some houses, this study included 25 region in North. and South in' Basrah city where the levels of heavy metals concentration were determined using flame atomic absorption spectrophotometer AAS after the laboratory digestion of dust samples using aqua regia, the study was conducted to include the effects of accumulation of heavy metals derivatives on soil surface as a result of emissions of such heavy metal and to include the effects on the environments. by this research it was found that the highest concentration level of lead in dust of Karmat Ali / Al- najebea (Kr.nj) sample in Karma Ali site equal to 160 mg/L then the maximum level of lead in dust of Hartha site also equal to 85 mg/L in gent sample the lowest level of lead 62mg/L and comparing to level 52 mg/L of lead in dust in Alzbeer site was found in N-Z sample, while the Higher level of lead in dust in South Alzbeer site was found in S-Z sample, equal to 70 mg/L and the lowest level of lead in dust in Karma site equal to 95 mg/L ,while the lowest of lead in dust in North Alzbeer in site St1 45 mg/L and lowest in S-Z 37 mg/L . The Cd and Cu very equality in parts that we are studies so as to concerted in Pb higher differently metal .

Key Words: Heavy metals Pb, Cd and Cu, Basrah city roads dusts, determination using atomic absorption AAS .

في أتربة شوارع مدينة البصرة Cu , Cd , Pdالكشف عن تواجد العناصر الثقيلة

حسين حسن حسين
فرع الكيمياء الصيدلانية /كلية الصيدلة / جامعة البصرة

الخلاصة

يتناول البحث الحالي قياس تلوث شوارع مدينة البصرة بالعناصر الثقيلة **Cu , Cd , Pb** حيث تم اخذ 100 عينة منها 50 عينة من شمال مدينة البصرة في منطقتي الهارثة وكرمة علي بالقرب من محطتي الهارثة الحرارية في منطقة الهارثة والنجيبية في منطقة الكرمة أما الخمسون عينة الأخرى تم أخذها من غرب مدينة البصرة وتحديدا في منطقة الزبير من الشوارع العامة والفرعية والحدائق وسطوح المنازل وحسب تركيز العناصر بجهاز مطياف الامتصاص الذري أللهبي AAS بعد هضم العينات مختبريا باستخدام خلطة الأحماض المركزة ودراسة تأثير هذه العناصر على البيئة وبالخصوص نتيجة انبعاث مشتقات الرصاص من مداخن أبراج محطتي الكهرباء في الهارثة والكرمة ومداخن السيارات فوجد أن أعلى تركيز Pb في عينة في تراب من منطقة كرمة علي / النجيبية (Kr.Nj) يساوي 160 ملغ / لتر ثم أعلى تركيز في عينة من منطقة الهارثة (Hr.Hr) حيث بلغ 85 ملغ / لتر وأدنى تركيز في نفس المنطقة 62mg / L وأعلى تركيز في شمال مدينة الزبير 52 ملغ / لتر وفي جنوب مدينة الزبير(S-Z) 70 ملغ / لتر وأعلى تركيز Pb في شمال مدينة البصرة في منطقة النجيبية بلغ 95 ملغ / لتر وبلغ أدنى تركيز Pb في غرب مدينة البصرة في شمال منطقة الزبير(N -Z) 45 ملغ / لتر وأدنى تركيز في جنوب مدينة الزبير(S-Z) 37 mg/L .

إن نسب العناصر الأخرى Cd ,Cu تكاد إن تكون متساوية في جميع المناطق التي تمت فيها الدراسة ولذلك تم التركيز على عنصر Pb المتفاوت النسب وبشكل ملحوظ .

الكلمات المفتاحية : العناصر الثقيلة Cu, Cd, Pb ، تراب مدينة البصرة ، تقنية الامتصاص الذري أللهبي AAS

Introduction

The street dust is defined in some recent studies (1,2,3) as the product of the interaction of solid, liquid and gaseous materials produced from different sources on the roads and may contain pollutants such as heavy metals and dangerous organic compounds, becoming a growing concern in recent years because it is a continuous contact with the habitants of cities (3), however, scarce information exist in developing countries limiting the appropriate evaluation of the levels of risk of the people who lives in the most important cities (2). Street dust has been identified as a potential source of lead exposure to human this heavy metal is released from the combustion of leaded gasoline. The heavy metal and other contaminants present in the soil surrounding the roads can reach the road via rain water,

also the dry and wet atmospheric deposition of vehicle wear and tear vehicular fluids and particular emissions all add to the level of the pollutants (4,5,6). In general urban system is regarded as complex matter and the polluted dust by lead, cupper and cadmium at the surface of roads gives variety of indications to the urban environment pollution (7,8,9). Lead continues to be an important element for environmental monitoring due the health effects so assessment of potential hazards and monitoring of remediation efforts are essential to providing a safe environment (10,11). For this reason concentrations of lead in street dust was recorded in some cities (12) and appears it has values ranging between 85 to 5060 µ /gm, and as a result of preventing leaded gasoline fuel that contained compounds $Pb(CH_3)_4$, $Pb(CH_3)_3(C_2H_5)$, $Pb(CH_3)_2(C_2H_5)_2$, $Pb(CH_3)(C_2H_5)_3$, or $Pb(C_2H_5)_2$ or even that contained lead halides such as PbBr2, $PbBr_2$, PbBrCl, Pb(OH)Br, $(PbO)_2$pbBr or $(PbO)_2$ PbBrCl as well as lead ammonium halides such as $PbBrCl.NH_4CI$ (13). In many local regimen the unleaded gasoline has been used which cause a reduce in lead concentrations in street dust for example in Caracas city was recorded level between 5.0 and 13.0 ug/gm and in Maracay city (1) recorded level between 2.0 and 4.0 µ /gm especially in dust of resident area. In recent research study (14) was recorded a diversity in concentration levels of lead in dust of crowded roads while other study (15) was found that lead in main streets ranging from 800 to 1000 µg/gm. The matter of pollution by heavy metals was attained great concern for

their toxicity and hazards on human health, environment and on agricultural crops near to roads (16). It is known that lead is health endangering metal for human and its effects include blood enzyme changes, anemia, hyperactivity, and neurological disorder (17). Excessive Cd exposure may give rise to renal, pulmonary, hepatic, skeletal, reproductive effects (18). It is known that Cu is essential element yet it may be toxic to both human and animals when its concentration exceeds the safe limits in some human tissues such as thyroid (19).

Obviously, the monitoring of lead cadmium and copper levels in the environment has a high importance. The Word Health Organization (WHO) reported tolerable weekly intake of Cd and Pb as 0.007 and 0.025 mg/kg

body weight respectively, for all human groups (16). Particularly in light of the impact of high blood Pb levels in children living in urban area and likelihood of this being caused by unintentional hand mouth contamination while children play in a city street (20-24). The aim of this research study was firstly to determine the average concentrations of three metals (Pb, Cd, Cu) in street dusts sampled from several region in Karma .and Hartha districts in Basrah city and to generate information for the level of traffic related to metal pollutants in these districts of Basrah .

Materials and Methods

General overlook on dust samples digestion by acids:

The dust sample digestion methods were found in many literatures that specializing in analysis of heavy metals differed when work with it using one of the following concentrated acids: HCI, HN03, $HClO_4$, HF or a mixture of some of them and sometimes using hydrogen peroxide H_20_2 (25-28), each time 1 gm from the dust sample was subjected to acid digestion using different temperature conditions (14,29,30) especially using 8 molar nitric acid alone. Some of the methods a 95° C digestion temperature was used for 2 hr (29) others digestion at 80° C for 3 hr (31) and sometimes with reflux (16,32). In the past century the concentric acid solution which is consisted from three volumes of HCI mixed with one volume of $HN0_3$ that it so called aqua regia was commonly used for digestion, this concentric acid solution was recently used for digestion 1 gm dust samples using temperature above boiling with reflux (1,16,33) and using kieldahl (34) in digestion. But recently (35) a digestion with lower temperature at 95° C and for a period approximately 1 hr using a modified acid mixture which consisted of $2HCI+2HNO_3+2H_2O$.

Sample Preparation :

Dust samples were gathered from demographic places of crowded population density in Basrah . city that encompassed roads, footpaths and housetops during intervals that no fall of rain happened. Samples were grinded using porcelain mortar, each specimen was divided into four parts (13): First part for test of humidity that measured using gravimetric method by heating at 105° C for 24 hrs. Second part for test of organic materials that measured muffle furnace (Type Carbolite CWF1200 was used) used at 450° C for 4 hrs. Third part for test of pH that measured using (HANNA pH 211Microprocessor was used) a mixture prepared from 1 portion of dust

with 2 portion of O.OIM aqueous solution of calcium chloride well shakes for 1 min then settled for 15 min and then the pH reading was taking to the supernatant. And finally fourth part test of heavy metals Pb, Cd and Cu.

Heavy metals Pb, Cd and Cu analysis using Flam atomic absorption spectroscopy technique.

In this work 20 ml of aqua regia has been used for digestion of 1.0 gm of dust sample, this acid solution was prepared from concentric(37%) HCI and concentric(69%) $HN0_3$ both obtained from AppliChem-company- GmbH Germany, the mixture was shacked for 24 hr then filtered and the filtrate was further centrifuged then the supernatant was diluted using volumetric flask by distilled deionized water to a 50 ml. A set of suitable standard solutions were prepared from 1000 mg /L stock solutions of Pb type HC813336, of Cd type HC813220 and of Cu type HC804298 all these stock were obtained form MERK company-Germany. An SHIMADZU AA-7000 flame atomic absorption was used for the determination of analyses where the optimum conditions for AAS are given in Table 1.

Table 1 operating parameter for AAS .

Parameters	Pb	Cd	Cu
Wavelength, nm	290	250.6	330
H.C.L current, rnA	8	9	9
Acetylene flow rate, L /min	1.5	1.2	1.2
Air flow rate, L /min	12	12	12
Slit, nm	0.7 .	0.7	0.7

Results and Discussion:

Calibration curves for Pb, Cd and Cu were obtained by using suitable standard solutions prepared from stock solutions. The graphs obtained were rectilinear in the concentration ranges of the curves were found as follow:

Recovery (R) =99 % for Pd , Regression Coefficient (r^2) =9908

Recovery (R) =100 % for Cd , Regression Coefficient (r^2) =1.0

Recovery (R) =96 % for Cu , Regression Coefficient (r^2) =9996

Where : the (r^2) is Reading for Six Date Running to each Sample was taking.

the (R) IS Reading for 25 sample was taking.

Sample collect places:

The number of dust sample according its type was 4 dust sample. type, and in this work each type was given appropriate name as follows: (1) N-Z for North Al-Zabeer street, (2) S-Z for South AL-zabeer street, (3) gent for

street near to AL-Najebea generator (4) AL-Hartha generator street.

According to Environmental Policy Alert, U.S. EPA (6,24) the safe concentration level of Pb of dust in urban residential areas is 5 mg/L, although, in Malaysia (35) it was recorded a level of Pb 35 mg/L in dust of main street, and Jordon (7) it was recorded a level of Pb 115 mg/L in dust of main street, whereas in Istanbul (29) it was recorded a level of Pb 165 mg/L in dust of main street, and in Europe (34) it was recorded a level of Pb 400 mg/L in dust of main street. From sited studies (29) Table 5 shows a comparison results of concentration levels for Pb, Cd and Cu in mg/L of dust in urban residential areas in major cities.

Table : 2 concentration levels for Pb, Cu and Cd of dust in urban residential areas in major cities and places (29) .

No.	Place / city	Cd mg/L	Cu mg/L	Pb mg/L
1	New York	8	355	2582
2	London	6250	61	413
3	Hong Kong	0.01	92	208
4	Madrid	0.01	188	192
5	Amman	2.5	69	219
6	Oslo	1.4	123	180
7	Bahrain	72	0.01	152
8	Lancaster	3.6	75	1090
9	Seoul	3	101	245
10	Taejon, Korea	0.01	47	60
11	Jordan	0.01	1.8	115
12	Istanbul	0.21	136	165

In this work Tables 3 and Table 4,5 shows values of concentration levels for Pb higher than EPA standard specification. For this reason it is recommended that attention must be taken into account and the community looking foreword to solve this problem, mainly by regulate the cases of vehicle jam in main streets in Basrah .

The higher concentration of Pb was found in dust ALkarma of Kr.nj equal to 160 mg/L as in Table 3 whereas in ALhartha was found equal to 85 mg/L in Table 3, 4 and 5 Figures 1-5 Whereas the higher concentration of Pb was found in dust sample was in North Alzbeer city N-Z equal to 52 mg/L whereas the higher concentration of Pd in dust sample was in south of

Alzbeer city 70 mgl L and the minimum concentration of Pb in AL karmasite was found equal to 95 mg/L for St. specimen in Table 4,5 Minimum in hartha 62 mg/L , in north of Alzbeer city 45 mg/L , And south Alzbeer 37 mg/L .

Table: 3 concentrations of Pb, Cu and Cd in mg/ L, and average percent of organic materials in Basrah

No	place	Cd mg/L	Cu mg/L	Pb mg/L	organic materials %
1	Hr .Hr	0.13	8.0	85	8.36
2	N-Z	0.16	18.5	52	10.47
3	Kr .nj	0.14	19.4	160	5.8
4	S-Z	0.15	9.0	70	16.4

Note: (1), Hr.Hr Hartha , (2) N-Z North Alzbeer street, (3) gent for street near to AI-najebea generator (4) for S-Z South Alzbeer street .

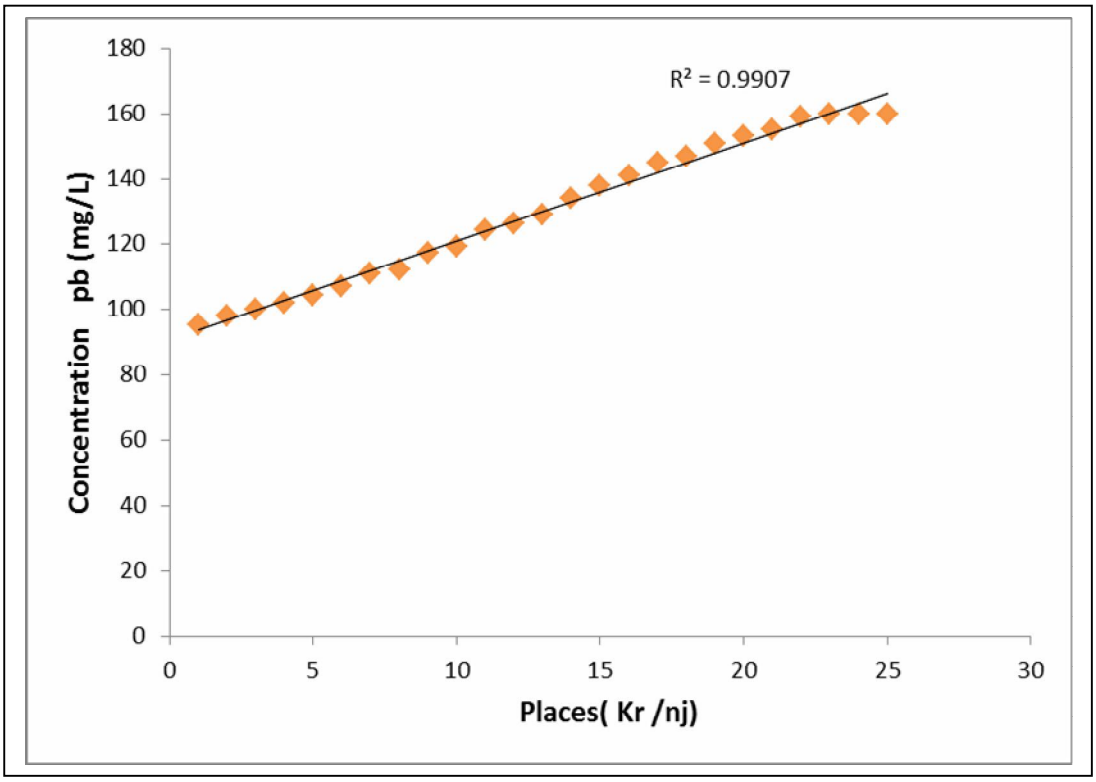
(2) In this work the number of the residential areas were 4 area including 25 sample in these areas at both of Basrah city: North and south of city (Karma, Hartha, North Alzabeer and south Alzabeer city.

(3) The result in table 3 refused to different percent of Organic materials in four region of Basrah

Collect at both places in North Al Basrah Pb)(

Table: 4 Sample

Place (Kr.nj)	Concentration mg/L	Place (Hr.Hr)	Concentration mg/L
St1	95	St1	62
St2	98	St2	63
St3	100	St3	64
St4	102	St4	65
St5	104	St5	66
St6	107	St6	67
St7	111	St7	68
St8	112	St8	69
St9	117	St9	69
St10	119	St10	70
St11	124	St11	71
St12	126	St12	72
St13	129	St13	73
St14	134	St14	74
St15	138	St15	74
St16	141	St16	75
St17	145	St17	75
St18	147	St18	76
St19	151	St19	78
St20	153	St20	78
St21	155	St21	79
St22	159	St22	80
St23	160	St23	82
St24	160	St24	83
St25	160	St25	85


R² = 0.9907
Concentration pb (mg/L)
Places(Kr /nj)
0
20
40
60
80
100
120
140
160
180
0
5
10
15
20
25
30

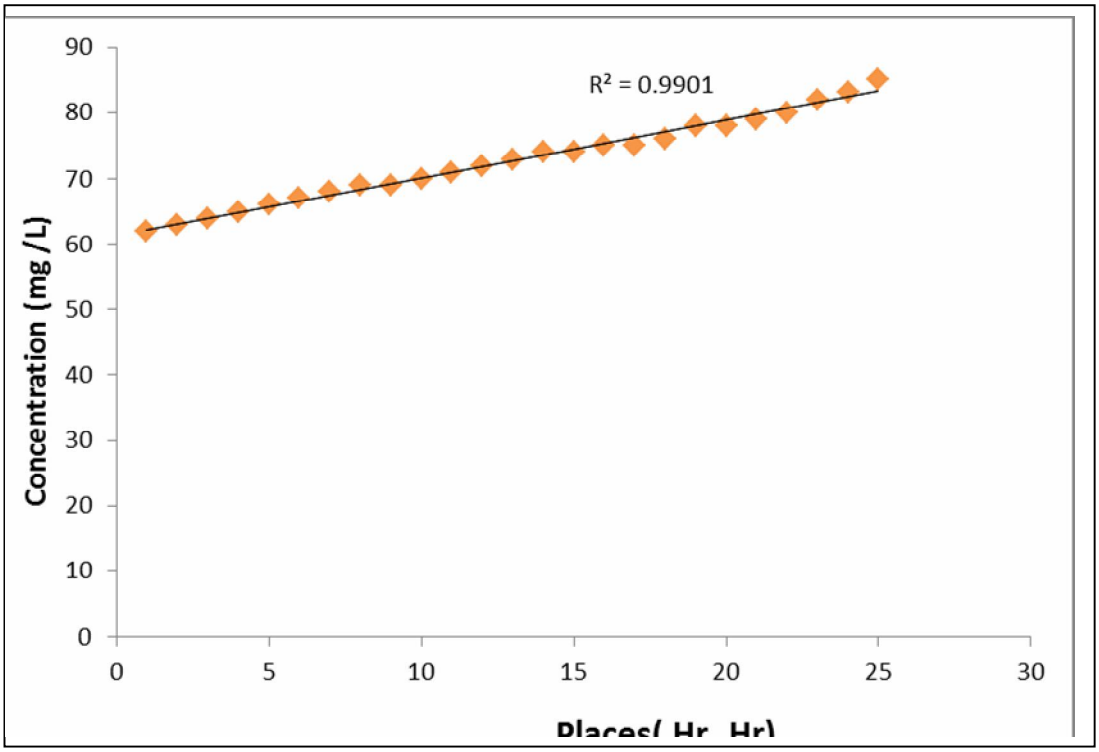

R² = 0.9901
Concentration (mg /L)
0
10
20
30
40
50
60
70
80
90
0
5
10
15
20
25
30

Figure 2: Curve of Pb in mg /L for each sites(Hr .Hr)

Place (N-Z)	Concentration mg/L	Place (S-Z)	Concentration mg/L
St1	45	St1	37
St2	45	St2	39
St3	45	St3	39
St4	45	St4	40
St5	45	St5	40
St6	45	St6	48
St7	45	St7	55
St8	45	St8	55
St9	45	St9	55
St10	50	St10	55
St11	50	St11	60
St12	52	St12	55
St13	52	St13	55
St14	52	St14	55
St15	52	St15	70
St16	52	St16	70
St17	52	St17	70
St18	52	St18	70
St19	52	St19	70
St20	52	St20	67
St21	52	St21	68
St22	52	St22	65
St23	52	St23	67
St24	50	St24	67
St25	50	St25	67

Table 5: Collect at both places in West Al Basrah Sample(Pb)

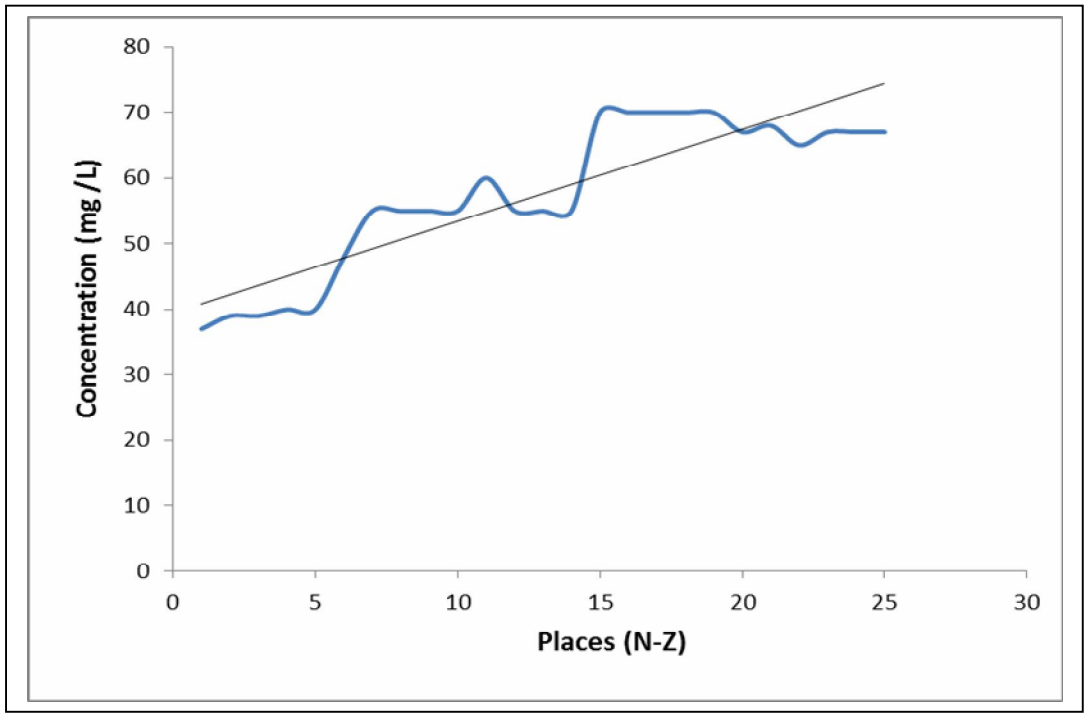


Figure 3: Curve of Pb in mg /L for each sites(N -Z)

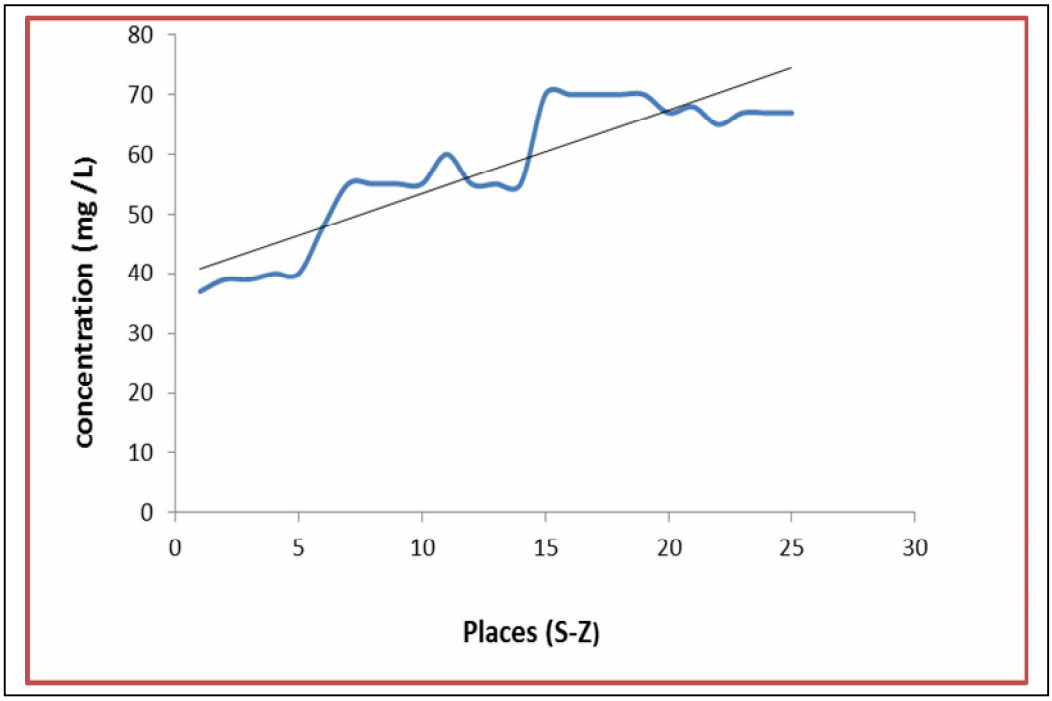


Figure 4: Curve of Pb in mg /L for each sites(S-Z)

No	Place	Cd mg/l	Cu mg/l	Pb mg/l	Organic materials %
1	N-Z	0.16	18.5	52	8.36
2	Kr.nj	0.14	19.4	160	10.47
3	Hr .Hr	0.13	8.0	85	5.8
4	S-Z	0.15	9.0	70	16.4

Table 6 : concentrations of Pb , Cu and Cd in mg /l ,and average percent of organic materials in both Region south and north

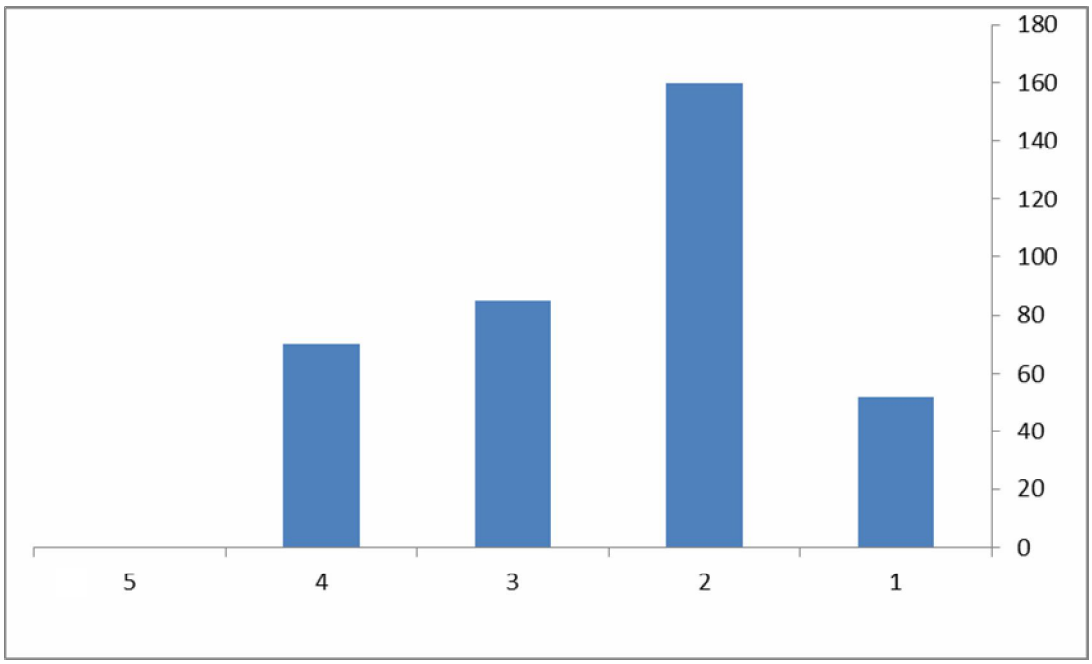


Figure 5: Concentration of Pb in mg /L for each sites

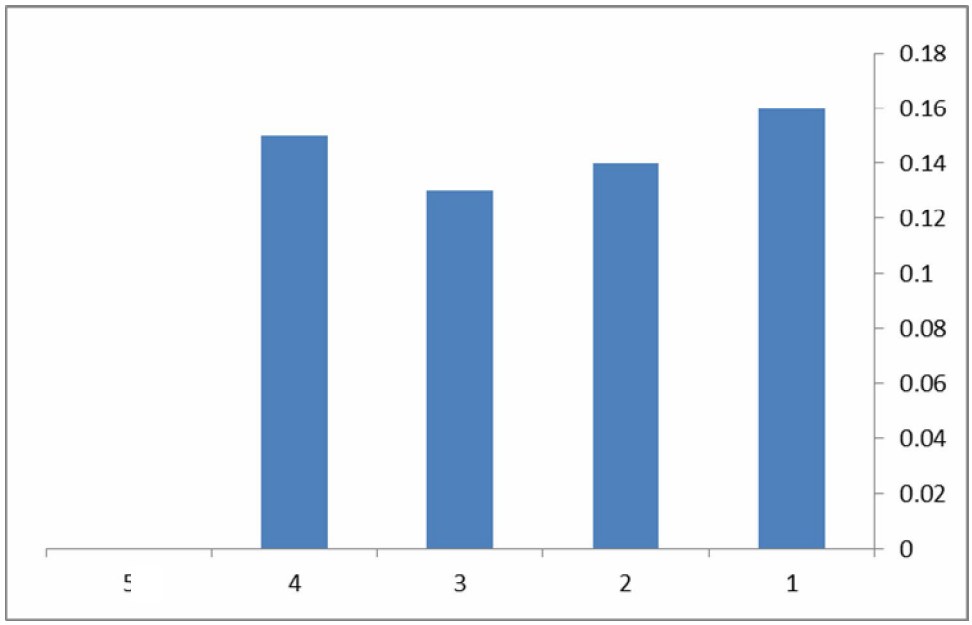


Figure 6: Concentration of Cd in mg /L for each sites

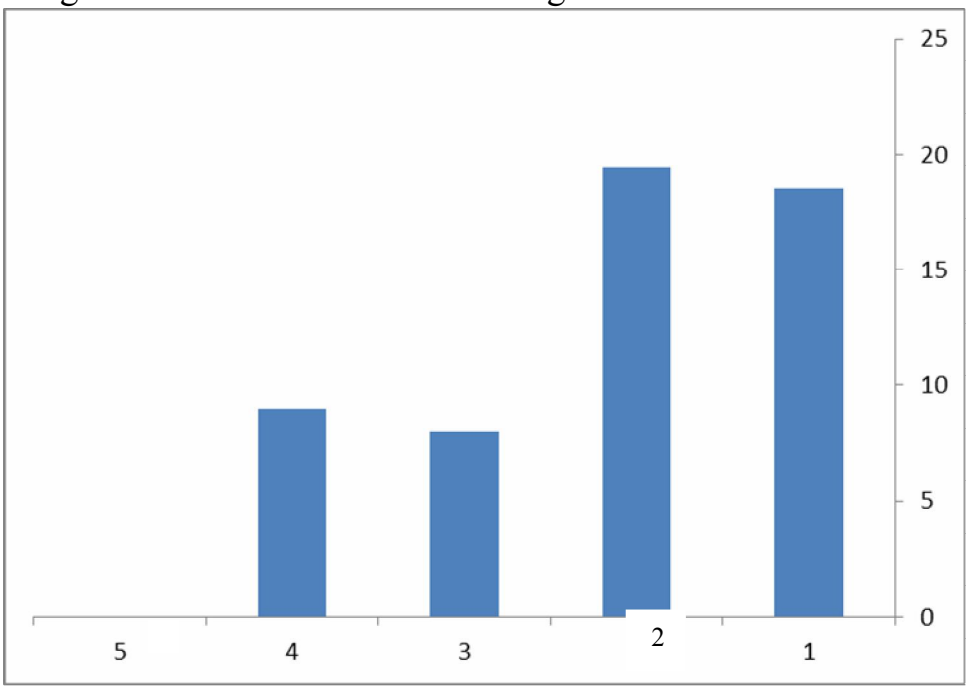


Figure 7: Concentration of Cu in mg /L for each sites

REFERENCES

1- Duran, A.C. and Gonzalez, A. (2009) "Determination of lead, naphthalene, phenanthrene, anthracene and pyrene in street dust" Int. J. Environ. Sci. Tech. 6(4): 663-670.
2- Shiggu, D.Y., Ogugbuaja, V., Barminas, J., and Toma, 1. (2007) "Analysis of street dust for heavy metal pollutants in Mubi, Adamawa, State" Nigeria Int. J. Phys. Sci .. 2(11): 290-298.
3- Xiangdong, L., Poon, C and Sum Liu, P. (2001) "Heavy metal contamination of urban soil and street dusts in Hong Kong" Appl. Geo. 16(11-12): 1361-1368.
4- Karbassi, A.R., Nouri, J. Mehrdadi, N. and Ayaz, G.O. (2008) "Flocculation of heavy metals during mixing of freshwater with Caspian Sea water" Environ. Geo. 53(8): 1811-1816.
5- Malakootian, M., Nouri, J. and Hassain, H. (2009) "Removal of heavy metals from paint industries wastewater using Leca as an available adsorbent" Int. J. Environ. Sci. 6(2): 183-190.
6- Saeedi, M., Hosseinzadeh, M., Jamshidi, A. and Pajooheshfar, S.P. (2009) "Assessment of heavy metals contamination and leaching characteristics in highway side soil, Iran" Environ Monit Assess 151: 231-241 .
7- Mashal, K. AI-Qinna, M. and Ali, Y. (2009) "Spatial distribution and environmental implications of lead and zinc in urban soils and dusts samples in Al-Hashimeych municipality" Jordan Journal of Mechanical and Industrial Engineering 3(2): 141-150.
8- Culloard, F.B., Thornton, 1., Watt, J., Wheatly, M., Moorroft, S., and Thompson, M., (1988) "Metal contamination in British urban dust and soils" J. Environ. Qual. 17: 226-234.
9- Lee, P., Youn-Hee, Yu., Seong-Tack, Y. and Bernhard, M. (2005) "Metal contamination and solid phase partitioning of metals in urban roadside sediments" Chemosphere 60: 672-689.
10- Sutherland, R.A., and Tolosa, C.A. (2000) "Multi-element analysis of road-deposited sediment in an urban drainage basin, Honolulu, Hawaii" Environmental Pollution 110: 483-495.
11- Farmer, P.(1987) "Lead pollution from motor vehicles 1974-1980" A selected bibliography. Elsevier, Amsterdam, 1-50.
12- Fergusson, J.E., Hayes, R.W., Yong, T.S. and Thiew, S.H. (1980) "Heavy metal pollution by traffic in Christchurch, New Zealand: lead and cadmium content of dust, soil and plant samples" New Zealand J. Sci. 23: 293-310.
13- Yesilonis, I.D., James, B.R., Pouyat, R.V. and Momen, B. (2008) "Lead forms in urban turf grass and forest soils as related to organic matter content and pH" Environ Monit Assess 146: 1-17.

14- -Lee, C. K., Low, K.S. and Lim, C.G. (1988) "Communication V lead in Kuala Lumpur urban dust" Pertanika 11(1): 157-160.
15- -Day, J.P., Hart, M. and Robinson, M.S. (1975) "Lead in urban street dust" Nature 253: 343-345.
16- Bakirdere , S. and Yaman, M. (2008) "Determination of lead, cadmium and copper in roadside soil and plants in Elazig, Turkey" Environ Monit Assess 136: 401-410.
17- Massadeh, A., Al-Sharif, L., Dalale'h, R. And Hassanet, M. (2006) "Analysis of lead levels in local Jordanian and imported sheep meat and organs using atomic absorption spectrometry" Environ Monit Assess 115: 87-93.
18- Nordberg, G. (2003) "Cadmium and human health: A perspective based on recent studies in China" J. of Trace Elements in Experimental Medicine 16: 307-319.
19- Yaman, M. and Akdeniz, I. (2004) "Sensitivity enhancement in flame atomic absorption spectrometry for determination of copper in human thyroid tissues" Analytical Sciences 20: 1363-1366.
20- Wong, J.W.C. and Make, N.K. (1997) " Heavy metals pollution in children playgrounds in Hong Kong and its health implications" Environ Technol vol. 18: 109-115.
21- Sharaf, N.E., Abdel-Shakour, A., Amer, N.M., Abou-Donia, M.A. and Khatab, N. (2008) " Evaluation of children's blood lead level in Cairo" Egypt Am. Eur. J. Agri Environ. Sci. 3(3): 414-419.
22- Tack, F.M.G., and Verloo, M.G. (1995) "Chemical speciation and fractionation in soil and sediment heavy metal analysis a review" International Journal of Environmental Analytical Chemistry Vol. 59: 225-238.
23- Milovanovic, M. (2007) "Water quality assessment and determination of pollution sources along the Axios Vardar River, Southeastern Europe" Desalination Vol. 213: 159-173.
24- Howden, S., Schneider, C. and Grosser, Z. (1996) "The analysis of soil, paint, and house dust for lead contamination" Atomic Spectroscopy-Perkin-Elmer Corp. 17(4): 171-175.
25- Balcerzak, M. (2002) "Sample digestion methods for the determination of traces of precious metals by spectrometric techniques" Analytical Sciences the Japan Society for Analytical Chemistry 18: 737-750.
26- Hseu, Z-Y. (2004) "Evaluation heavy metal contents in nine composts using four digestion methods" Bioresource Technology 95: 53-59.
27- Zhu, W., Bian, B. and Li, L. (2008) "Heavy metal contamination of road - deposited sedimentsin a medium size city of China" Environ Monit Assess 47: 171-181.

28- Nasralla, M.M. (1984) "Lead in Jaddah urban dust" Environ. Poll. Series B. 8: 133-141.
29- Yeimoglu, E.K. and Ercan, O. (2008) "Multivariate Analysis of metal contamination in street dusts of Istanbul D-I00 highway" J. Braz. Chem. Soc. 19(7): 1399-1404.
30- Suuzuki, K., Yabuki, T. and Ono, Y. (2009) "Roadside Rhododendron pulchrum leaves as bioindicators of heavy metal pollution in traffic areas of Okayama Japan" Environ Monit Assess 149: 133-141.
31- Paudyn, A.M. and Smith, RG. (1990) "Applications of inductively coupled plasma atomic emission spectrometry in occupational health" I of Analytical Atomic Spectrometry 5: 523-529.
32- Paudyn, A.M. and Smith, RG. (1992) "Microwave decomposition of dusts, ashes, and sediments for the determination of elements by ICP-AES" Canadian I of Applied Spectroscopy 37(4): 94-99.
33- Shnggu, D.Y., Ogugbuaja, V.O., Barminas, IT. and Toma, I. (2007) "Analysis of street dust for heavy metal pollutants in Mubi, Adamawa State, Nigeria" Int. I Phys. Sci. 2(11): 290-293.
34- Ewen, C., Anagnostopoulou, M. A., and Ward, N.I. (2009) "Monitoring of heavy metal levels in roadside dusts of Thessaloniki, Greece in relation to motor vehicle traffic density and flow" Environ Monit Assess 157: 483-489.
35- Muhamad-Darus, F., Nasir, RA., Sumari, S.M., Ismail, Z.S. and Omar, N.A (2011) "Nursery schools: Characterization of heavy metal content indoor dust" Asian J. of Environment-Behaviour Studies 2(6): 53-60.