IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 9, September 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

Determination of Heavy Metals (Pb,Cd,Zn,Cu,Ni,Co) in Street Soil of Shattrah City.

Ibtihaj Ahmed Kahdim

Physics department College of science / University of the Qar –Iraq

Abstract:-

The study is concerned evaluation street dust pollution in shattrah city by heavy metals .taking 20 dust samples from shattrah city including crowded general street ,bystreet ,and from some street nearer to main electrical generators .The levels of heavy metals concentration were determined using flame atomic absorption spectrophotometer (AAS) after the laboratory digestion of dust samples using(AL-Janabi ,1992). The results obtained from heavy metals determination in this research showed that concentration of Pb from (97.3) to (266) ppm ,Cd concentration was from (7.3) to (13.9) ppm , Zn range from (55)to(104) ppm while concentration Cu , Ni and Co were the rang from (13)to(34.1)ppm,(11.7) to(34.2)ppm, and (12)to(25.4)ppm respectively .The coefficients variance reveled that one group of metals effected by anthropogenic pollution principle component analysis extracted two major components PC1with high loading of Pb ,Cd ,Zn, is the result is suggested of the industrial activities and PC2 with contribution of Cu ,Cr and Ni due to use of soil constituent processes of anthropogenic influences .Assessment of environmental state of soil by means of geochemical load indices (GLI) calculated for each metal showed that concentration of heavy metals were great in all element .That showed moderately to high pollution at street shattrah city.

Key Word : The shattrah city , The heavy metals ,Environmental pollution .

Introduction

Soil contamination with heavy metals has become a matter of great scientific and scientific importance in light of evidence of its extreme toxicity to human health and biological systems. Because heavy metals

are a natural substance of the earth's crust. Have an impact on the activities of human radical and change the balance and biochemical cycle of some heavy metals. Therefore, the concentration of soil elements has been a matter of great importance in past years not only for farmers but also for the environment(Anzawa et al., 2004) . The street soil is defined in some recent studies (Duran& Gonzalez ,2009 ; Shiggu ,et al,2007; Xiangdong ,et al,2001) as the product of the interaction of solid ,liquid and gaseous materials produced from different source on the road 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 (Xiangdong ,et al ,2001) . An evaluation of the environmental hazard due to soil pollution is of particular importance for agricultural areas ,because heavy metals ,which are chronic harmful to human health , remain in soils for a very long time (Moren ,et al.1994). 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 city street (Wong &Make,1997;Howden,et al,1996) . it is known that lead is health endangering metal for human and its effects include blood enzyme changes ,anemia ,hyperactivity ,and neurological disorder (Massdeh, et al,2006).Excessive Cd exposure may give rise to renal ,pulmonary ,hepatic ,skeletal, reproductive effects (Nordberg,2003). while the geographic distribution of Zn indicates that zinc anomalies are located near the main cities in region ;however ,zinc does not migrate very far in arid climate and alkaline media(Aubert and Pinta ,1977). it is known that Cu is essential element yet it may be toxic to both human and animals concentration exceeds the safe limits in some human tissues when its such as thyroid.(Yaman & Akdeniz,2004) .The Cr content of surface soil is known to increase due to pollution from various sources ,of which the main one are several industrial wastes (electroplating sludge , Cr pigment and tannery wastes ,leather manufacturing wastes),and municipal sewage sludge .The added Cr to soils is usually accumulated at the thin top layer,(Beckett et al.,1979 and Uminska, 1988). The nickel status in soils is highly dependent on the Ni content of parent rocks .However ,the concentration of Ni in from increases its toxicity effects ;compared with Cr and Pb ,which are usually present in less mobile from in soil (AL-Bassam and AL-Mukhtar ,2007).

The aim

This study was firstly to determine the average concentrations of heavy metals (Pb , Cd, Zn , Cu , Ni , Cr) in street soils sampled from several

region in shattrah city and to generate information for the level of traffic related to metal pollutants in these districts of shattrah .

Study Area

Shatrrah is located on a branch of the Gharraf River, which descends from the Tigris River in the central Euphrates region of southern Iraq about 350 km south of the capital Baghdad at latitude 31,4175 and latitude 46,1777 and its population is 254,000 according to the statistics of 2014. And follow administratively and geographically to the province of Dhi Qar is located midway between Baghdad and the southern provinces and the Arabian Gulf. This is what enabled it to occupy a vital geographical location for its control over the transportation and road transport between Baghdad and the Arabian Gulf on the one hand and between Baghdad and the rest of the southern cities on the other. The district of Shattrah is the second largest district in Iraq, with an area of (2,384 km^2). It is administratively bordered on the east by Maysan governorate. On the west side is Al-Nasr district. On the north side is the district of Rifai and the south is Nasiriyah. (Eidani, 2011), Figure (1).

Materials and Methods

The primary and secondary streets (study area) samples were collected during two different phases in 2017. The first campaign was in April 2017, soil surface samples were collected from a 5cm uncle excavated in the entire study areas. The second phase was completed in June 2017. Dry samples were kept in polyethylene bags while wet samples were stored after drying under the sun for two days after modeling. The processes were performed according to the geochemical survey procedures identified by GEOSURV (Benni, 2011). According to the standard standards of the General Company for Survey of Geological Mining as follows (Al-Janabi ,et al ,1992):

1- Dry the sample for two hours under temperature (100 ̊C)

using the electric oven

2-Take (1 g) of sample in a 250 mL container using a sensitive scale

3-Add (150 mL) of HCl with (5 mL) of HNO3 to the sample to be A

4-.Place the sample in a sandy bath (45-60) minutes

5-Cool the sample and add (5 ml) of HCl and (50 ml) distilled water to clean the shape of the baker.

6-Heat the mixture until it boils for(2-3) minutes

7-Filter the mixture using filter paper (42) and put the liquid mixture in a bottle of (100 ml)

8-Finally, wash the heating vessel and add the washing water to the mixture to fill the bottle (100ml) again and analyze the mixture by atomic absorption spectrometer (AAS).

The analysis was carried out in the laboratories of service biology at the University of Baghdad. Analytical precision was controlled by analyzing several parameters, and compared with industrially prepared soil standards

Results and Discussion

The results of geochemical analysis are summarized in the Table (1)
Fig(1) shows range concentration of various elements in study area.

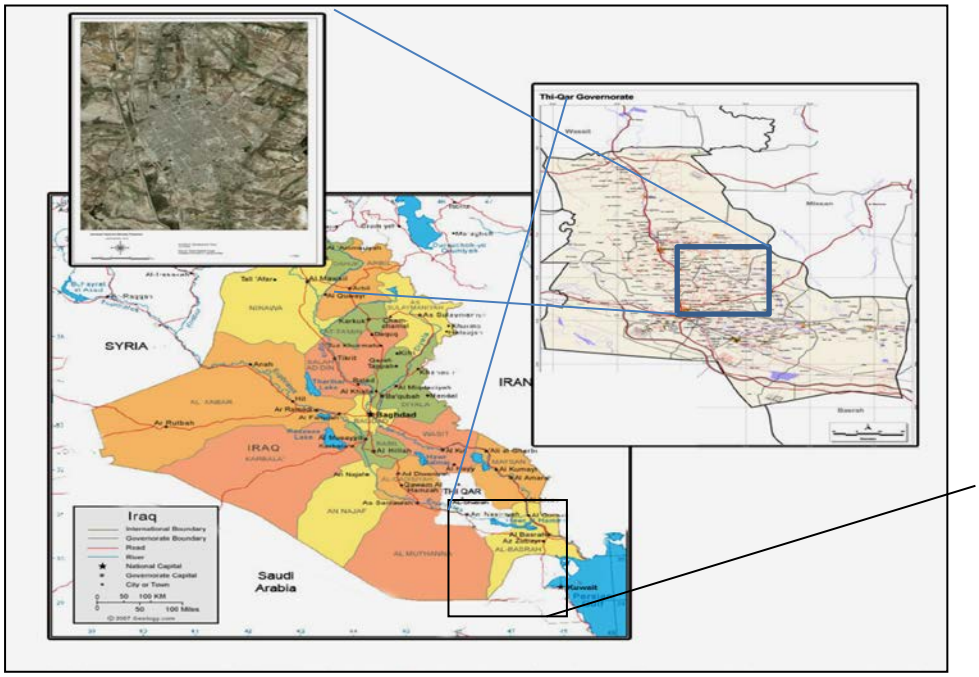

Figure (1) Map of the city of Nasiriyah showing a map and aerial picture of the city of Shatrah

Table (1): concentration levels of heavy metals of dust in study area.

Locations of the study area	Symbol of specimen	The concentrations of heavy metals (ppm)					
		Pb	Cd	Zn	Cu	Ni	Co
Al-Mahkama street	St1	105	9.7	95.2	32	12	14.5
Hay Al-Moalemeen street	St2	97.3	7.3	82	13	18	19.8
Al-shomaly street	St3	102.8	10	83	15	12	12.7
Baghdad garage street	St4	202.5	11.5	90	21.8	11.9	13.9
Al-Moahed street	St5	113.7	11	72	18	17	12
Dubai street	St6	99.8	8	67	17	11.7	15
Industrial street	St7	238	13.2	78	30.4	34.2	25
Akad street	St8	202.2	12.5	98.9	23.7	32.8	21
Beny Zaid street	St9	220	13	95	21	30.1	25.4
Al-Felka street	St10	223	11.9	101.1	22	31.1	24.5
Al-Adel street	St11	200	11	97	18.7	30.7	23.6
Al-Etfaa street	St12	211.3	10	87	17.6	29.7	21.5
Al-Gensia street	St13	198	8.9	96	16	25	20.1
Hay Al-Askary street	St14	215.7	10.1	66.9	19.6	18	18
education College street	St15	150	7	55	15.4	15.2	14
Al-shealaa street	St16	177.8	8.2	75	14.9	16.7	13.4
Al-Mealaab street	St17	201.6	9.1	67	17	20	20.5
The hospital street	St18	223	9.7	92	21	21.9	17.2
Jaleel Fotheal street	St19	252	13.9	104	32.4	25.1	16.1
Al-Haawy street	St20	266	13.5	103	34.1	26.8	21.3
Average		191.773	10.116	83.227	19.672	21.555	18.54
Lindsay ,1979		10	0.06	50	50	40	8

In this study, the number of residential areas in Shatrah was 20 in these .areas in the north and south of the city

A short symbolic name suitable for the study areas was given as shown in Table (1)Fig (1). The concentration of lead, cd, zinc, and co was found in most areas of study and the concentration of the copper and nickel elements was limited but did not exceed the limit for the global organization of polluted areas. Pollution in the general urban system is complicated. Dust contaminated by lead, lead and cadmium falling on the surface of the roads, giving a variety of indicators of pollution of the urban environment (Meshaal et al., 2009; Coleard et al., 1988; Lee et al., 2005). In this study, we observe the high level of lead concentration in all study areas, as shown in Table (1) and Figure (2).

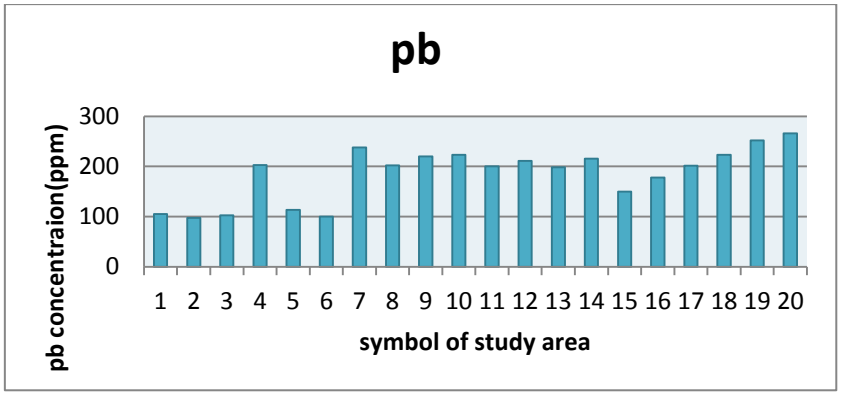

Figure 2: The concentration of lead in the dust street of study area.

While Cd concentration was recorded in the dust street ranging (8-13.9) ppm with average (10.116) Above the limit(0.06 ppm)(Lindsay,1979).it was within the range in the soil (5ppm)(Aziz,1995).Highest value of Cd was in the sample dust of (St.19) Table (1) Fig(3).Increasing of Cd due to the incineration of plastic materials can cause an increasing of Cd concentration in atmosphere then accumulates on the soil dust street (Baird,2001).

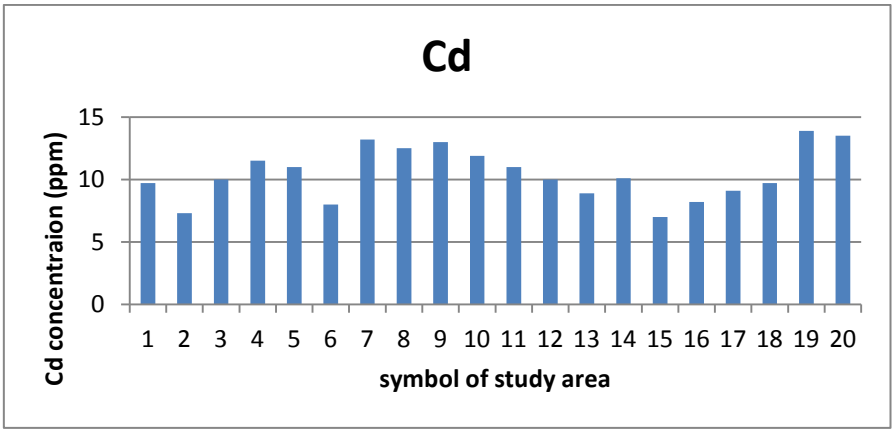

Figure 3: The concentration of cadmium in the dust street of study area.

The values of Zinc in the soil dust ranging (55-104 ppm) with a mean (83.227 ppm) Table(1) Fig(4),most the values of Zn were above limits in the soil (70 ppm) according to (Lindsay ,1979).the highest one was in (St.19) while the lowest value was in (St.15) .Zinc connecting by a strong positive relation with (Cd,Cr,Cu,Ni,and Pb) ,organic matter and the ratio of clays ,this strong relation with these elements due to their origin from basic and ultra-basic igneous rock and weathering of different sedimentary rock and the influence of anthropogenic activities (Al-Saady,2008).

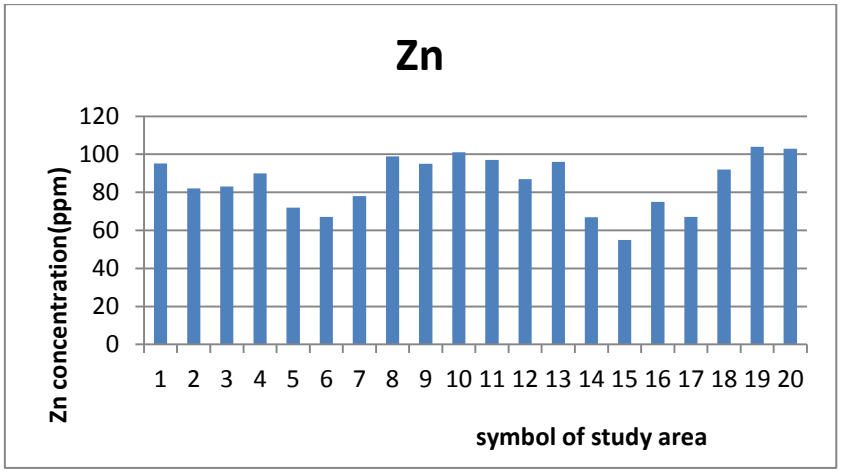

Figure 4: The concentration of Zinc in the dust street of study area.

The concentration of Cu in the soil of shattrah street was ranging (13-34.1 ppm) with a mean (19.672 ppm) ,The concentration of copper in this study was less than the limit(50 ppm) according to (Lindsay ,1979) in all study areas Fig(5). Copper is found in the crystalline structure of primary and secondary soil minerals. It is also associated with soil organic matter, reduces osteoporosis and anemia, and leads to copper poisoning (Essential of Medical Geology ,2005).

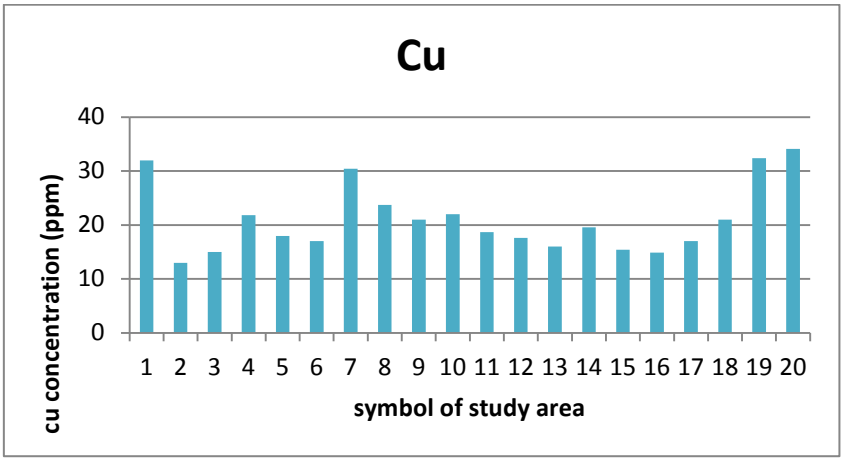

Figure 5: The concentration of copper in the dust street of study area.

The mean of Nickel in this study was ranging (11.7-34.2 ppm) (21.555) ppm) , The lowest values of Ni in all soil dust were not exceed the limits in soil (40 ppm) according to (Lindsay ,1979) Fig (6) . It is known that untreated or not filtered emission from types of combustion and incineration will carry different trace metals.

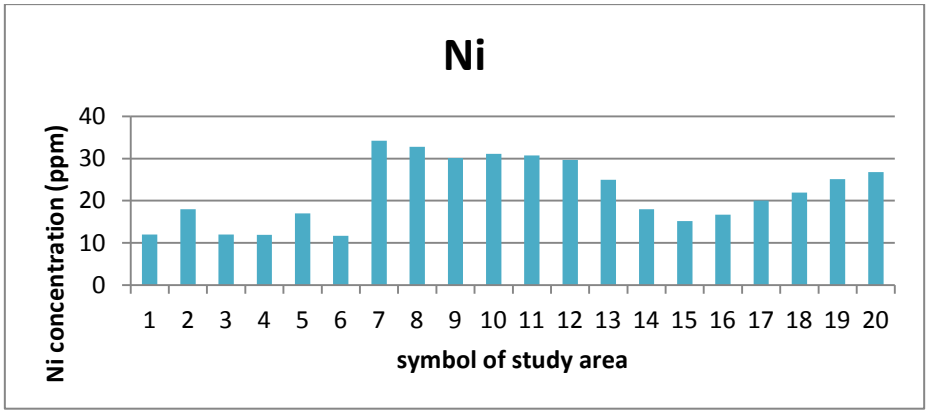

Figure 6: The concentration of Nickel in the dust street of study area.

According to Table (1) Fig (7) , the concentration of Cobalt is higher than the limit (Aubert,1977) .Increasing in the concentration of Cobalt in the soil affected by different factors : the origin and the formation of the soil ,weathering processes ,anthropogenic activities ,in addition to sewage water (Al-Maliky ,2005).

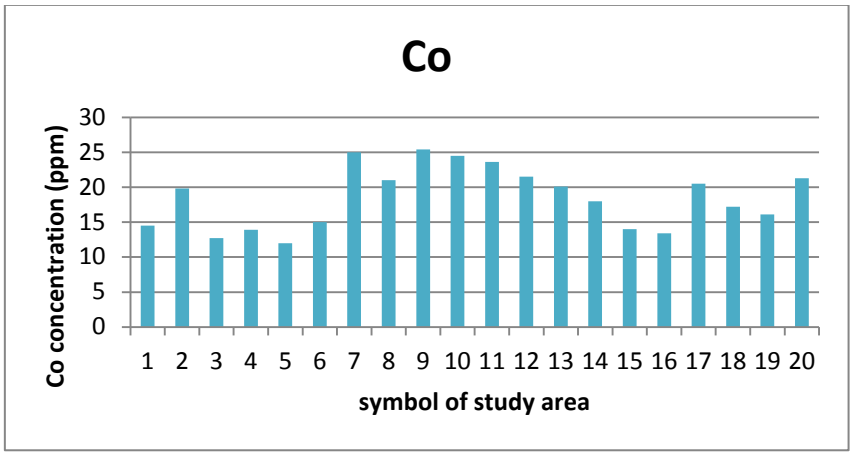

Figure 7: The concentration of Cobalt in the dust street of study area.

According to Table(2) , the concentration of heavy elements is higher than the limits allowed for previous studies. The cause of high concentrations in street dust in some cities (Ferguson et al., 1980) shows that its values range from (97.3 to 266) ppm. As a result of the use of fuel Leaded gasoline containing lead compounds $(CH_3)_4$, or lead $(C_2H_5)_2$, or even containing lead halides such as $PbBr_2$, Pb (PbOH)Br, or (PbO_2) with birkel as well as halidides of ammonium lead PbBrCl. NH_4CL (Yesilonis et al., 2008), from specific studies (Yeimoglu & Ercan, 2008).

Table(2):global studies of individual pb ,Cu and Cd metals concentration of dust in urban residential areas in major cities and places (Yeimoglu,2008).

No	Place / city	Cd (ppm)	Cu(ppm)	Pb(ppm)
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	2.21	136	165

Table (2) s'hows a comparison results of concentration levels for Pb, Cd and Cu in ppm of dust in urban residential areas in major cities .According to environmental .policy Alert , U.S.EPA(Saeed ,et al,2009;Howden,et al ,1996) the concentration level of pb of dust in urban residential areas is 5 ppm , although, in Malaysia (Muhamad ,et al,2011) it was recorded a level of Pb 35 ppm in dust of main street and Jordon (Mashal ,et al ,2009) it was recorded level of Pb (115 ppm) and recorded at a level of Pb 400 ppm in dust of main street Europe.

In this study table (1) Fig (8) is shown values of concentration levels for pb higher than EPA standard specification .they reason it is recommended that attention must be taken into account and community looking forwards to solve this problem mainly by regulate the cases of vehicle jam in main streets in shattrah city , and you must clean the streets using cleaning automotive vehicles to reduce further pollution metals originated from of common anthropogenic source with probably automobiles as a major common source which are including gasoline , engines and tires .

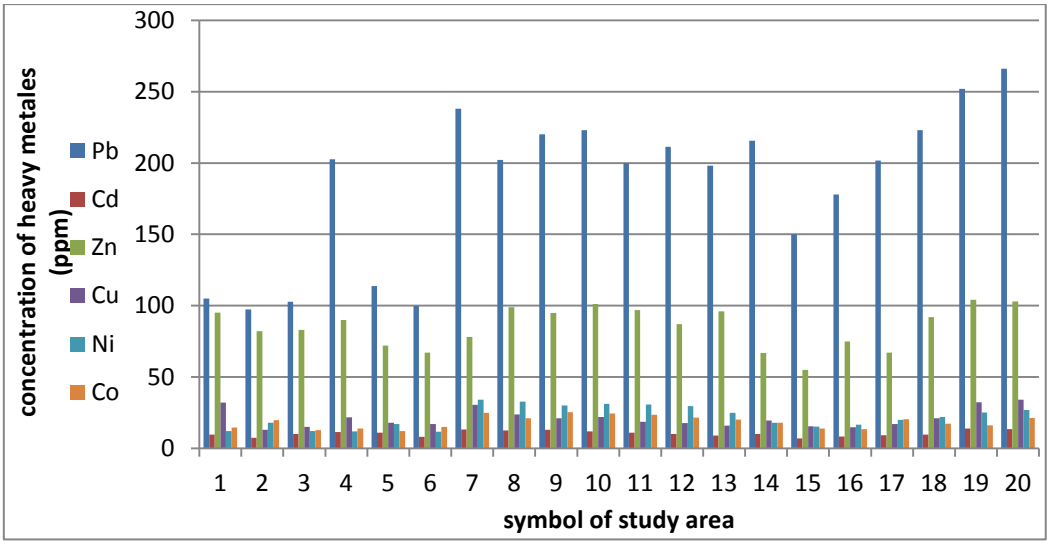

Figure 8: The concentration of heavy metals in the dust street of study area.

Conclusion

In this study results proved that measurement of total concentration of heavy metal consider as pollution index , also conclude these sites to the station of tetraethyl lead .

The metals mentioned before have the ability to accumulated in the environment and effect on people working in and out the sites , therefor precaution must be taken to reduce the risk of these metal on public health . The highest concentrations were detected in sample collected from electric generator and there was trend of a decrease in metal contents with the increasing distance from street paving .

These concentration levels indicate that street dust contamination by heavy metals originated from a common anthropogenic source with probably automobiles as a major common source which are including gasoline , engines and tires . So to reduce pollution should be encouraged to use unleaded gasoline and compel automobile manufacturer companies to use platinum of calaydic silencers .

References:

Al-Bassam ,K.S.,and Al-Muktar,L.,(2007),Heavy minerals in the sediments of the Euphrates River in Iraq ,Iraqi Bull ,Geol .Min, vol .4,No .1, pp 29-41.

Al-Eidani, Abbas Abdul-Hussein and Al-Khalidi, Qassim Matar ,(2011), The reality of public services for rural residents of Shatrrah district and their regional relationship by the two researchers, Journal of Literature Basra, No. 56, pp 239-258.

Al-Janabi,AY.,Al-Saadi ,NA,Zainal,YM., Al-Bassam ,MR,(1992) ,work procedures of the SE of geological survey and mining (Geosury),21(B), pp59-65.

Al-Maliky ,M.A., (2005),Assessment of water and soil in Baghdad City using Geographical information system (GIS),PhD thesis ,University of Baghdad, college of Science ,Dept.of Geology ,pp 171.

Al-Saady,Y.I.I., (2008), Environmental Geochemistry and Mineralogy of Hor AL-Chekka southern of Al Msharrah River within Missan Governorate ,MSc .Thesis University of Baghdad ,College of science,Dept.of Geology, pp208.

Anazawa,K.,Kaida,Y.,Shinomura,Y.,Tomiyasu,T., and Sakomoto,H. , (2004) ,"Heavy metals distribution in river waters and sediments a round a "firefly village", shikoku ,Japan :application of Multivariate analysis ,The Japan society for analytical chemistry ,vol.20, pp 79-84.

Aubert,H. and Pinta ,M.,(1977) ,Trace elements in soils, Developments in soil science ,Elsevier scientific publishing Co., Amsterdam ,pp 395.

Aziz ,A.M.,(1995),Effect of some heavy metals in the solid waste and waste water on the growth of lettuce and soil contamination , MSc. Thesis, University of Baghdad ,College of Agriculture, pp 70.

Baird,C.,(2001), Environmental chemistry ,University of Western Ontario, W.H,Freeman and company ,New York ,vol(1), pp 398-401.

Beckell, P.H.T.,Davis,R.D.,Brindley ,P.,and Chem,C.,(1979), The disposal of sewage sludge onto farmland the scope of the problem of toxic elements .water pollute control,No.78,pp 419.

Benni,Th,J,.,(2011),GEOSURV work procedure part 13,Geochemical Survey GEOSURV ,int.rep,no.,1994.

Culloard ,F.B., Thornton ,I.,Watt,J.,Wheatly ,M.,Moovroft,S., and Thompson ,M., (1988), Environ ,Qual,17,pp226-234.

Duran,A.C.and Gonzales ,A.,(2009)"Determination of lead , naphthalene , phenanthrene ,anthracene and pyrene in street dust "Int .J .Environ. Sci.Tech.6(4), pp 663-670.

Essentials of Medical Geology ,(2005) ,Impacts of the Natural Environment on Public Health Olleselinus ,Geological Survey of Sweden,2005.

Fergusson ,J.E.,Hayes,R.W.,Yong,T.S.,and Thiew,S.H.,(1980),New Zealand ,J.Sci,23, pp 29-310.

Howden ,S., Schneider dust,C. ,and Grosser ,Z.,(1996),"The analysis of soil ,paint, and house for lead contametric", Atomic Spectroscopy –perkin –Elmer corp.17(4),pp171-175.

Howden ,S.,Schneider,C.and Grosser,Z.,(1996),Atomic Spectroscopy –Perkin –Elmer Crop,17(4),pp171-175.

Lee,P.K.,Yu,Y-H.,Yun,S-T.,and Bernhard ,M.,(2005),Chemospherc,60, pp 672-689.

Lindsay ,W.L.,(1979),Chemical equiliberia of soils ,John Wiley and sons ,pp449.

Mashal .K.Al-Qinna,M. ,and Ali,Y .,(2009), Jordan Journal of Mechanical and Industrial Engineering , 3(2),pp141-150.

Massadeh,A., Al-sharif,L .Dalaleh ,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),pp 87-93.

Moren, A.N .,Perez ,L., and Gonzales ,J.,(1994),Soil parameters Contributing to heavy metal dynamics in perimet –ropolitan from land area –Geo microbiology J.,pp 325-345.

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),pp53-60.

Nordberg,G.,(2003),"Cadmium and human health : A perspective based on recent studies in china ",J ,of Trace Elements in Experimental Medicine (16), pp307-319.

Saeedi,M.,Hossein Zadeh,M.,Jamshidi,A.,and Pajooheshfar,S.P,(2009),Environ Monit Assess,151,ppm231-241.

Shiggu,D.Y.,Ogugbuaja ,V.,Barminas ,J and Toma ,l.,(2007),"Analysis of street dust for heavy metal pollutants in Mubi , Adamawa,state" ,Nigeria , Int.J .Phys,sci,2(11),pp 290-298.

Wong,J.W.C.,and Make ,N.K.(1997)"Heavy metals pollution in children playgrounds in Hong Kong and its health implications", Environ Tiron Technol,vol(18), pp109-115.

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):pp1361-1368.

Yaman,M.,and Akdeniz ,I.(2004),"sensitivity enhancement in flame atomic absorption spectrometry for determination of copper in human thyroid tissues" Analytical sciences ,20,pp1363-1366.

Yeimglu,E.K., and Ercan ,O.J.,(2008),Braz Chem ,Soc.19(7) ,pp 1399-1404.

Yesilonis,L.D.,James,B.R.,Pouyat,R.V.,and Momen,B.,(2008),Environ Monit Asses, 146, pp 1-17.