مجلة القُلزم للدراسات التطبيقية

مجلة القلزم للدراسات التطبيقية
QUZUM JOURNAL FOR APPLIED STUDIES

ISSN: 1858 - 9553

علمية دولية مُحكمة - تصدر بالشراكة مع جامعة دنقلا - السودان

في هذا العدد:

RSBCRSC

العدد السابع - ذو الحجة 1445هـ - يونيو 2024م

فهرسة المكتبة الوطنية السودانية - السودان

مجلة القُلزم للدراسات التطبيقية

Qulzum Journal for Applied Studies

الخرطوم : مركز بحوث ودراسات دول حوض البحر الأحمر 2024

تصدر عن دار آريثيريا للنشر والتوزيع - السوق العربي الخرطوم - السودان

ردمك: 1858-9553

ترسل الأوراق العلمية على العنوان التالي
هاتف: +249121566207 - +249910785855
بريد إلكتروني: rsbcrsc@gmail.com
السودان - الخرطوم - السوق العربي
عمارة جي تاون - الطابق الثالث

موجهات النشر

تعريف المجلة:

مجلة (القُلزم) للدراسات التطبيقية، مجلة علمية مُحَكمة تصدر عن مركز بحوث ودراسات دول حوض البحر الأحمر - السودان بالشراكة مع جامعة دنقا- السودان. تهتم المجلة بالبحوث والدراسات العلمية والمواضيع ذات الصلة بدول حوض البحر الأحمر.

موجهات المجلة:

1. يجب أن يتسم البحث بالجودة والأصالة، وألا يكون قد سبق نشره قبل ذلك.
2. على الباحث أن يقدم بحثه من نسختين. وأن يكون بخط (Traditional Arabic) بحجم 14 على أن تكون الجداول مرقمة وفي نهاية البحث وقبل المراجع على أن يشار إلى رقم الجدول بين قوسين دائريين ().
3. يجب ترقيم جميع الصفحات تسلسلياً وبالأرقام العربية بما في ذلك الجداول والأشكال التي تلحق بالبحث.
4. المصادر والمراجع الحديثة يستخدم أسم المؤلف، اسم الكتاب، رقم الطبعة، مكان الطبع، تاريخ الطبع، رقم الصفحة.
5. المصادر الأجنبية يستخدم اسم العائلة (Hill, R).
6. يجب ألا يزيد البحث عن 30 صفحة، وبالإمكان كتابته باللغة العربية أو الإنجليزية.
7. يجب أن يكون هناك مستخلص لكل بحث باللغتين العربية والإنجليزية على ألا يزيد على 200 كلمة بالنسبة للغة الإنجليزية. أما بالنسبة للغة العربية فيجب أن يكون المستخلص وافياً للبحث بما في ذلك طريقة البحث والنتائج والاستنتاجات، مما يساعد القارئ العربي على استيعاب موضوع البحث وبما لا يزيد عن 300 كلمة.
8. لا تلزم هيئة تحرير المجلة بإعادة الأوراق التي لم يتم قبولها للنشر.
9. على الباحث إرفاق عنوانه كاملاً مع الورقة المقدمة (الاسم رباعي، مكان العمل، الهاتف، البريد الإلكتروني).

نأمل قراءة شروط النشر قبل الشروع في إعداد الورقة العلمية.

بسم الله الرحمن الرحيم

الحمد لله رب العالمين، والصلاة والسلام على سيدنا محمد وعلى آله وصحبه أجمعين

وبعد:

القارئ الكريم ،،،

السلام عليكم ورحمة الله وبركاته.. نطل على حضراتكم من نافذة جديدة من نوافذ النشر العلمي، وهي **مجلة القُلزم للدراسات التطبيقية**، ونحن في غاية السعادة والمجلة تصل عددها السابع بفضل الله تعالى ومنته.

القارئ الكريم:

هذه المجلة تصدر بالشراكة مع جامعة دنقلا، وهي إحدى الجامعات السودانية الفتية التي وضعت بصمات مميزة في مسيرة البحث العلمي، وهذا العدد هو السابع في إطار هذه الشراكة العلمية التي تأتي في إطار استراتيجية مركز بحوث ودراسات دول حوض البحر الأحمر، في تفعيل الحراك العلمي والبحثي داخل السوداني وخارجه.

القارئ الكريم:

هذا العدد يشتمل على العديد من البحوث والدراسات المهمة ذات البعد النظري والتطبيقي، ولضمان نجاح واستمرارية هذه المجلة بإذن الله تعالى، نأمل أن يرفدنا الباحثون بمزيد من إسهاماتهم العلمية المميزة.

مع خالص الشكر والتقدير للجميع

أسرة التحرير

المحتويات

Determination of Lead level Concentration in Gash River's Soil, Sudan

■ **A. Nugod Algaily Mohamed**
PhD. Student , Faculty of post graduate
University of Kassala

■ **Dr. Abdelgadir Mohamed Ahmed**
Associate professor in Chemical Engineering,
Dept of Chemistry. Faculty of Education,
University of Kassala

■ **Dr. Osman Mohamed Saad**
Associate professor in Chemical Engineering,
Dept of Chemistry. Faculty of Education,
University of Kassala

Abstract:

Lead metal occurs naturally in the Earth's crust. It is widely used and consequently resulted in environmental contamination and relevant public health problems, world widely. This study aims to determine level of Lead metal concentration in the Gash River's Soil, Kassala State, Sudan. Fifteen (15) Soil samples were collected randomly from areas of Wadsharifi, Awetala ,Hayalgasor and Kormota during 2019 AD following retreating of Gash's flood. The Soil samples were digested using Nitric and Hydrochloric acids as the requirement of ICP - OES techniques, while SPSS was used for data analysis. The results show significant differences in means concentrations of lead in the soil samples of the selected areas with a general average of less

than100 mg /kg for the Lead level concentration in soil recommended by World Health Organization.

Keywords: Heavy metals, Soil contamination, Lead element, Gash River, pollution.

تحديد تركيز مستوى الرصاص في تربة نهر القاش، السودان

أ. نجود الجيلي محمد الخضر
طالبة - دكتوراه - كلية الدراسات العليا - جامعة كسلا

د. عبد القادر محمد أحمد
أستاذ مشارك - قسم الكيمياء - كلية التربية - جامعة كسلا

د. عثمان محمد سعد محمد
أستاذ مشرك - قسم الكيمياء - كلية التربية - جامعة كسلا

المستخلص:

يتواجد معدن الرصاص بشكل طبيعي في القشرة الأرضية. تم استخدامه على نطاق واسع، وبالتالي يؤدي إلى التلوث البيئي ومشاكل الصحة العامة ذات الصلة، على نطاق واسع في العالم. تهدف هذه الدراسة إلى تحديد مستوى تركيز معدن الرصاص في تربة نهر القاش، ولاية كسلا، السودان، تم جمع خمسة عشر (15) عينة من التربة بشكل عشوائي من مناطق ود شريفي، أويتلا، حى الجسر والكرمته، خلال العام 2019م، بعد انحسار فيضان القاش. تم هضم عينات التربة باستخدام أحماض النيتريك والهيدروكلوريك حسب متطلبات تقنيات ICP-OES، بينما تم استخدام برنامج SPSS لتحليل البيانات. أظهرت النتائج وجود فروق معنوية في متوسطات تراكيز الرصاص في عينات التربة للمناطق المختارة حيث بلغ المتوسط العام أقل من 100 ملغم/كغم لمستوى تركيز الرصاص في التربة الموصى به من قبل منظمة الصحة العالمية.

الكلمات المفتاحية: المعادن الثقيلة، تلوث التربة، عنصر الرصاص، نهر القاش، التلوث.

1. Introduction:

Lead is a chemical element with an atomic number 82 and symbol Pb and nowadays recognized as a heavy-metal poisonous, it affects every system of the body. Acute exposure to a high level of Lead can result in death or significant damage to the brain or other organs. (Abdirashid and Mohammed, 2019). Environmental pollution is a major challenge in the recent era of modern society. Among different environmental contaminants, heavy metals are well known and are of greater concern due to their toxicity for living organisms and marine life. Waste disposal is a serious global environmental issue resulting in heavy metal pollution of soils, water, and crops. However, heavy metals like lead, cadmium, and mercury are toxic to living organisms not only in high concentration but also in low concentrations. (Bakshi S et al. 2021). However, the pollution from human activities has contributed to the high occurrence heavy metals into the ecosystem (Rasmussen C et all, 2007). Heavy metals are a unique class of naturally occurring elements that persist in the environment for a long time and are not biodegradable (Muhammad et al. 2022). Heavy metals are metals with a specific gravity higher than 5 g cm–3. The most common environmental heavy metals are copper (Cu), nickel (Ni), chromium (Cr), lead (Pb), cadmium (Cd), mercury (Hg), iron (Fe) and arsenic (As) Some heavy metals, such as iron and nickel are essential to the survival of all forms of life at low concentrations, Generally, heavy metals are naturally occurring components of the earth's crust with large differences in concentrations. The term heavy metal alludes to any metallic chemical element that has a comparatively high density and is poisonous at low concentrations (Cacar, 2003). Heavy metals can accumulate in the soils to toxic levels as a result of long-term application of untreated waste waters and fertilizers. Soil irrigated by waste water accumulate heavy metals in surface soils and when the capacity to retain heavy metals is reduced due to repeated application of waste water, heavy metals leach into ground water or soil solution available

for plant uptake (Papatilippaki et al., 2008). Among the pollutants that persist and accumulate in the soils include; inorganic toxic compounds for example fertilizers, organic wastes, organic pesticides and radio cucleides (Misra and Mani, 2009; Jia et al., 2010). The concentration of heavy metals in soil and their impact on ecosystems can be influenced by many factors such as the parent rock, climate and anthropogenic activities (Jia et al., 2010). Soil is often contaminated by human activities and this is reflected in the high horizontal and vertical variability brought about by the anthropogenic influence on soil formation and development (Fong et al, 2008).

1.1 The research problem:

Environmental pollution remains are important issue for population, economic and political decision factors in all countries. Many countries are affected by pollutants from different pollution sources: chemical industries, iron and steel smelter, coal mining and thermal power stations, cement factories, auto traffic, the use of pesticides and fertilizer, so, it is vital to know the elemental concentration of heavy and toxic elements in Sudan. The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metals that are harmful to humans include mercury, lead, and arsenic. Chronic exposure to these metals can have serious health consequences. Humans are exposed to heavy metals through inhalation of air pollutants, consumption of contaminated drinking water, exposure to contaminated soils or industrial waste, or consumption of contaminated food. Food sources such as vegetables, grains, fruits, fish and shellfish can become contaminated by accumulating metals from surrounding soil and water. Heavy metal exposure causes serious health effects, including reduced growth and development, cancer, organ damage, nervous system damage, and in extreme cases, death. Exposure to some metals, such as mercury and lead, may also cause development of autoimmunity, in which a person's immune system attacks its own cells. This can lead to joint diseases

such as rheumatoid arthritis, and diseases of the kidneys, circulatory system, and nervous system. (ToxFaQs, 1993). Soil is a very important natural resource to man as it is a source of his life on this planet. Without soil the earth would be as barren as the moon hence lifeless, Materials that find their entry into the soil system persist and accumulate in toxic concentrations becoming sources of pollution in the soil (Misra and Mani, 2009). The main object of this paper is to determine Lead element concentration level in El-Gash river soil at the end of the flood in eastern Sudan using Inductively Coupled Plasma Optical Emission Spectrometry techniques.

2. Materials and Methods:

2.1 Collection of soil samples:

Four different areas were selected using GPS technique in the course at the end of the flood of El- Gash River in Kassala State eastern Sudan ,15 samples of water at the beginning of the flood of El - Gash Rive were collected from the areas of (Wadsharifi (1Aw, 5 samples) , Awetala (1Aa ,4 samples , Hay Algasor (1Ah ,3 samples) and Kormota (1Ak, 3 samples), andkeep in one liter plastic bottles separately the interior of the plastic bottles being previously rinsed three times, each water sample was acidified with Nitric acid to preserve the water from contamination.

2.2. Methods:

2.2.1 The Principle of Inductively Coupled Plasma Optical Emission Spectrometry Method:

Optical emission spectrometers with inductively coupled plasma (ICP-OES) have a linear relation several times the power of ten between the intensities measured and the concentration of an element. This means that quantification by means of external calibration with a linear regression line is possible. The calibration should be adjusted to the working range. Even for the lowest

concentration values, sufficient measuring sensitivity and reproducibility must be assured, an aliquot of a well-mixed, homogeneous aqueous or solid sample is accurately weighed or measured for sample processing, For total recoverable analysis of a solid or an aqueous sample containing un dissolved material, analyses are first solubilized by gentle refluxing with nitric and hydrochloric acids, after cooling, the sample is made up to volume, is mixed and centrifuged or allowed to settle overnight prior to analysis. For the determination of dissolved analyses in a filtered aqueous sample aliquot. (Perkin- Elmer,2004).

2.2.2 Preparation of Reagents:

Hydrochloric acid (1:1) was prepared by adding 500 mL of Concentrated HCl to 400 mL reagent water, the mixture were diluted to One Liter.

Hydrochloric acid (1: 4) was prepared by adding 200 mL of concentrated HCl to 400 mL reagent water, the mixture were diluted to One Liter.

Nitric acid (1:1) was prepared by adding 500 mL of concentrated HNO3 to 400 mL reagent water , the mixture were diluted to One Liter. (Perkin-Elmer,2004).

2.2.3. Preparation Standard solutions:

Standard solution containing (0.5, 1, and 5) ppm and 100µg/liter of Pb were prepared (acidified to maintain pH at (1- 2), the Calibration curves determines the relationship between the intensity of light emitted at a specific wavelength and the concentration of the element in the solution.

2.2.4 Preparation of Soil samples:

1 g of the sample was weighed in a beaker and 4 mL of (1:1) HNO3 and 10 ml of (1:4) HCl were added to the beaker, the lip of the beaker was covered with a watch glass, the beaker was Placed on a hot plate for reflux extraction of the

analysts. The hot plate was located in a fume hood and previously adjusted to provide a reflux temperature of approximately 95°C (Perkin- Elmer. ,2004).

2.2.5. Data analysis:

Data was analyzed using SPSS. The data were expressed in term of descriptive statistics while the figures were presented with Mean values. A p-value less than 0.05 were considered as Significant.

4. Results and Discussion:

4.1 Results:

Table 1: show the Quantities of lead in soil samples in ppm as determined by the Inductively Coupled Plasma Optical Emission Spectrometry method.

No of Samples	Sample code	Lead conc.(ppm)
1	1Bw	1.00
2	1Bw	1.00
3	1Bw	1.00
4	1Bw	1.3
5	1Bw	1.5
6	1Ba	1.00
7	1Ba	1.00
8	1Ba	1.9
9	1Ba	2.3
10	1Bh	10
11	1Bh	13.3
12	1Bh	8.8
13	1Bk	7.4
14	1Bk	3.7
15	1Bk	2.3

Table 2: Show the Statistic comparison of lead in Soil samples at the end of the flood of El- Gash River

Descriptive Statistics

	NO.	Minimum	Maximum	Mean	Std. Deviation
Wadsharifi (S,A)	5	1.00	1.50	1.1600	.23022
Awetala (S,A)	4	1.00	2.30	1.5500	.65574
Hayalgasor (S,A)	3	8.80	13.30	10.7000	2.33024
Kormota (S,A)	3	2.30	7.40	4.4667	2.63502
Valid N (listwise)	3				

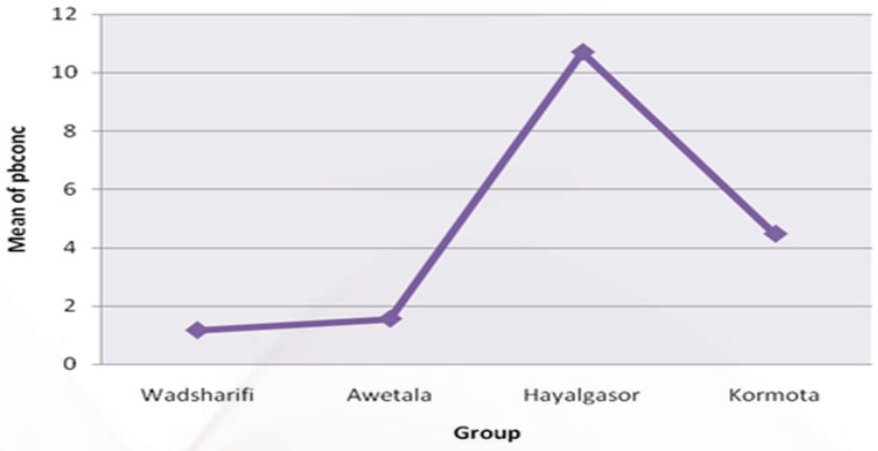

Figure 1: Show the Means of Lead - Concentration level in soil at the end of the flood of El- Gash River in the studied Areas.

Table 3: Multiple Comparisons of lead concentration in Soil samples at the end of Al-Gash Flood. Tukey HSD

(I) block	(J) block	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Wadsharifi	Awetala	-.39000-	1.03625	.981	-3.5086-	2.7286
	Hayalgasor	-9.54000-*	1.12812	.000	-12.9351-	-6.1449-
	Kormota	-3.30667-	1.12812	.057	-6.7018-	.0885
Awetala	Wadsharifi	.39000	1.03625	.981	-2.7286-	3.5086
	Hayalgasor	-9.15000-*	1.17982	.000	-12.7007-	-5.5993-
	Kormota	-2.91667-	1.17982	.120	-6.4674-	.6341
Hayalgasor	Wadsharifi	9.54000*	1.12812	.000	6.1449	12.9351
	Awetala	9.15000*	1.17982	.000	5.5993	12.7007
	Kormota	6.23333*	1.26128	.002	2.4374	10.0292
Kormota	Wadsharifi	3.30667	1.12812	.057	-.0885-	6.7018
	Awetala	2.91667	1.17982	.120	-.6341-	6.4674
	Hayalgasor	-6.23333-*	1.26128	.002	-10.0292-	-2.4374-

4. 2 Discussion:

Table 1. Summarize data on lead content in soil sample at the end of the flood of the Gash River by the Inductively Coupled Plasma Optical Emission Spectrometry method of the studied samples. The concentration of lead was ranged between 1.00-13.30 mg/kg. The highest concentration of lead (13.30 mg/kg) was found in Hayalgasor samples and the lowest concentration (1.00 mg/kg) was found in Wadsharifi samples. The mean concentration of lead in soil by the Inductively Coupled Plasma Optical Emission Spectrometry method was (4.46 mg/kg) which was less than the amount allowed by the WHO. The mean elemental concentration of lead in this study were higher

than in the previous studies (Muayad .H.et al 2015), (Atiemo et al., 2011) ,and (Endal Teju et al 2012) . However higher lead levels than the present study was also recorded in other study (Wafaa.S. Eman.A.,2016), (Okonola et al. ,2007), (Adelekan and Abegunde 2011), (Jaradat et al., 1999),and (Mico et al., 2006).

Table 2. shows a multiple comparison of concentration of lead in soil samples at the end of the flood of the Gash River between the studied groups. The mean difference was significant at the 0.05 level. Samples from Wadsharifi was done to make a comparison between the concentration of lead in soil samples at the end of the flood of the Gash River samples from Wadsharifi have the mean value (1.16 mg/kg) was the lowest value among all other means which prove the amounts of lead concentration in the lowest concentration of lead (1.00 mg/kg) and the highest concentration of lead was (1.50 mg/kg) .The concentration of lead may have reached the river as a result of the natural decomposition of rocks due to the nature of the mountainous region that the river crossed on its arrival.

samples from Awetala have an average value (1.55 mg/kg) was the lowest concentration of lead was (1.00 mg/kg) and highest concentration of lead in this area was (2.30 mg/kg). Samples from Hay Algasor have an average value (10.7 mg/kg) the lowest concentration of lead was (8.80 mg/kg) and highest concentration of lead in these area was (13.3 mg/kg) .Lead concentration in this region is the highest compared to other regions and this is because A landfill located on the course of the river in this area or from agricultural fertilizers and fuel stations that may have been swept into the riverbed due to rain water and air pollution with car exhaust due to the presence of the bridge in this site. The mean concentration of lead in soil samples at the end of the flood of the Gash River of Kormota samples (4.46 mg/kg) the lowest concentration of lead was (2.30 mg/kg) and highest concentration of lead in this area was (7.40 mg/kg).

Table 3: Show the Multiple Comparisons of lead concentration in soil samples at the end of the flood of the Gash River with group, the results were analyzed with SPSS test and Since P value (sig 0.00) is less than 0.05 we reject the null hypothesis and we accept the alternative that means there was significant difference in the concentration of lead in soil between the samples collected from Wadsharifi and Hay Algasor sample (sig 0.00). Significant difference between the concentration of lead in Awetala and the concentration of lead in soil from Hayalgasor was found (sig.0.00). sample of soil collected from Kormota and Hay Algasor was found (sig 0.002). The concentration of lead in soil from Hayalgasor showed significant differences to samples collected from all other areas (sig 0.00).

5. Conclusion:

Soil Contamination of Lead may expose a risk by direct ingestion, Smelling, take-up in vegetable ranches and Soil, the Inductively Coupled Plasma Optical Emission Spectrometry method is fairly selective, precise, and more sensitive, The method is free from interferences which is an advantage of this method. Therefore, the method can be used for routine analysis of soil. The study has shown that there were considerable fairly small amounts of lead element in the Gash River's soil, based on the above analysis levels of lead in the soil were less than the permissible limit of the World Health Organization. Hayalgasor had higher levels of lead in the soil and this can be attributed to the presence of many pollutants in this area.

6. Recommendations:

The following may be recommended from this research and should be taken to the researchers in this area:

1. Sources of lead in Soils like inorganic fertilizers, pesticides and acaricides need to be controlled. Fertilizers, pesticides and acaroids are known to be the source of lead, which have been detected in Soils and water at high levels.

2. Hayalgasor had the highest contamination levels of lead in water and soils. Sincemost of the soil sampling was done around area, there is need to institute mechanisms to reduce the level of contamination including fixing the sewerage system, and checking on the conditions of automobiles that ply the town routes.

3. Further research similar to this one must be carried out in other areas of Kassala state, especially in the town center.

7. Acknowledgments:

The researcher wish to acknowledge certain institutions and individuals for their contributions towards the production of this research, extend our heartfelt gratitude to the RICI Company Ltd for Chemical and Environmental Testing Laboratory Services Dammam ,KSA Staff for their efforts.

acknowledge also extended to my supervisors staff due to the successful completion of this study would not have been accomplished without the guidance, assistant and support of them.

References:

(1) Abdirashid Adam Isak & Dr. Mohammed Mubarek Awad,2019, Determination of Lead Levels in Soil for Some Areas at East Gezira and Khartoum – Sudan, Africa A Comparative Study between the Rural Areas and Urban Areas, Global Journal of Science Frontier Research: B Chemistry Volume 19 Issue 2 Version 1.0

(2) Adeleken, B. and Abegunde, K. (2011). Heavy metal contamination of soil and ground water at automobile mechanic village in Ibadan, Nigeria. International Journal of the Physical Sciences; 6: 1045-1058.

(3) Atiemo, S.; Ofuso, F.; Mensah, K.; Tutu, O.; Palm, L. and Blackson, A. (2011). Contamination assessment of heavy metals in road dust from selected roads in Accra Ghana. Research Journal of Environmental and Earth sciences; 3: 473-480.

(4) Bakshi S, Banik C and He Z (2018) The impact of heavy metal contamination on soil health, In: Managing soil health for sustainable agriculture (Reicosky, ed.), 2(8): 1–36.

(5) Cacar, 2003: Canadian Contaminants Assessment Report II, Sources, Occurrence, Trends and Pathways in the physical environment, Northern Contaminants program, Minister of Indian Affairs and Northern Development, Minister of Public Works and Government Services Canada, p,p. 332.

(6) Endale.T Feleke. Z. Chandravanshi ,Negussie .M. Feleke. Z., (2012), Determination of the levels of lead in the Roadside soils of Addis Ababa, Ethiopia. Sinet: Ethiop.J.Sci .,35(2):81-94.

(7) Fong, F.; Seng, C.; Azan, A. and Tahir, M. (2008). Possible source and pattern distribution of heavy metals content in urban soil at Kuala

Terengganu Town Centre. The Malasian Journal of Analytical Sciences; 12: 458-467.

(8) Jaradat, M. and Momani, A. (1999). Contamination of roadside soil, plants and air with heavy metals in Jordan, a comparison study. Turk journal of Chemistry; 23: 209-220.

(9) Jia, L.; Yonghua, L. and Yang, L. (2010). Heavy metals in soil and crops of an intensively farmed area: Case study in Yucheng City, Shandong province, China. International Journal of Environmental Research and Public Health; 7: 395-412.

(10) Misra, S. and Mani, D. (2009). Soil pollution. New Delhi, India: S. B Nangia APH publishing corporation. Pp 29-59.

(11) Muhammad Afzaal a, SamanHameeda, IramLiaqatb, Amir Amanat Ali Khanc, Hafiz abdulManand, Raja Shahide and Muhammad Altafe, 2022. Heavy metals contamination in water, sediments and fish of freshwater ecosystems in Pakistan, Water Practice & Technology Vol 17 No 5, 1253 doi: 10.2166/wpt.2022.039.

(12) Mico, C.; Peris, M.; Sanchez. and Recatala, L. (2006). Heavy metal content of agricultural soils in a Mediterranean Semiarid area: the Segura River Valley (Alicante, Spain). Spanish Journal of Agricultural Research; 4: 363-372.

(13) Muayad.H. Mohammed, Ali H.Amtehgy ,Amal. A. Mahmood (2015), Determination of lead in water, Roadside Soil, Plant and Blood in Basrah City -Iraq. Journal of Babylon University /pure and Applied Sciences /No.(2)/Vol .(23).

(14) Okunola, O.; Uzairu, A. and Ndukwe, G. (2007). Levels of Trace metals in soil and Vegetation along major and minor roads in Metropolitan City of Kaduna, Nigeria. African journal of Biotechnology; 6: 1703-1709.

(15) Perkin- Elmer CO, (2004), Concepts, Instrumentation and Techniques in Inductively Coupled Plasma Optical Emission Spectrometry ,third Edition.

(16) Papafilippaki, A.; Kotti, M. and Stavroulakis, G. (2008). Seasonal variations in dissolved heavy metals in the Keritis River Chania, Greece. Global Nest Journal; 3:320-325.

(17) Rasmussen C, Matsuyama N, Randy A, Dahlgren, Randal J and Southard NB (2007) Soil genesis and mineral transformation across an environmental gradient on andesitic lahar. Soil Sci. Soc. Am. J., 71(1): 225–237

(18) ToxFaQs. Lead. Agency for toxic substances and disease registry. April 1993.

(19) Wafaa Sahib. A, Eman Abdul Mahdi, (2014). Study the Pollution of some Calcareous Soils with Cadmium and Lead and Its Relationship with the Accumulative Effect of UsedEngines Oils on Mineralogical Soil Separates. Mesopotamia Environmental Journal, Special Issue B:54-6

دار آريثيريا للنشر والتوزيع
Arrythria for Publishing and Distribuation

ISSN: 1858-9553 ردمك