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The Role of the Vegetative Part in Some Plant Species to Uptake and Accumulate Lead Element from Polluted Air (an Applied Study in Baghdad /Karkh in Iraq)

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Abstract

The current study was conducted to test the efficiency of the vegetative part (plant leaves) of plant species of shrubs and trees involved in forming semi-artificial vegetation in the city of Baghdad, Karkh, in the uptake and accumulating the lead element that pollutes the air in the city atmosphere. Five plant sampling sites were selected: Al-Kadhimiyah, Al-Mansour, Al-Ma'aml (Al-Salam district), Al-Adl, and Al-Ameriya district intersections (Al-Seklat), and symbols were given (A, B, C, D, E) respectively. The spread and distribution of plants vary in terms of human activities and pollution levels, affecting the five sites that recorded more than 20 species. For a real comparison between plant efficiency and the effect of the nature of the region, species of recurrent and non-recurring shrubs and trees were selected in their presence at the study sites and included (Conocarpus lancifolius, Ziziphus spina christi, Eucalyptus sp., Albizia lebbeck), and non-recurring (Nerium oleander, Dodonaea viscosa, Phoenix dactylifera, Olea europaea, Myrtus communis, Ficus nitida, Citrus aurantium). The study's results showed a variation in the ability of plant species in lead accumulators. The first site of the plants (Conocarpus lancifolius, Ziziphus spina christi, Albizia lebbeck, Eucalyptus sp., Nerium oleander, Dodonaea viscosa, Phoenix dactylifera, Olea europaea, Myrtus communis, Ficus nitida, and Citrus aurantium) was recorded at (0.46, 0.56, 0.36, 0.55, -, 0.68, -, -, 0.33, 0.29, 0.84) respectively. The second site of the same plants was (0.74, below the detection limit, 0.25, 0.57, -, -, 0.16, -, -, 0.31, -) respectively. The third site was (0.95, 0.65, 0.832, 0.831, 0.86, 1.02, -, -, -, 0.436, -, 0.532), respectively. The fourth site was (0.34, 0.95, 0.48, 0.40, -, 0.19, -, -, -, -), respectively. The fifth site was (0.48, 0.50, 0.49, 0.41, -, -, -, 1.45, -, -, -, -) ppm, respectively. The current study was conducted from October 2021 to May 2022.

Keywords: Plant species, Lead element, Plant leaves, Pollution levels, Lead accumulators.

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1.Introduction

The concept of air pollution refers to the presence of substances in the surrounding air harmful to humans or other biological contents, whether with low or high concentrations [1]. Air pollution is one of the most important environmental problems in the world. However, its damage is more evident in life in low-income developing countries that still depend on biomass fuels as a primary energy source. Therefore, the burden of this problem in these countries is higher than that of the developed countries [2] and [3]. The World Health Organization (WHO) estimated the number of deaths from air pollution at 7 million in 2012, which is likely to increase [4]. Heavy metals are the most dangerous species of inorganic pollutants [5]. They are hazardous to the surrounding environment and its components due to their non-biodegradable. Therefore, their ability to survive in the environment, for example, lead accumulation in the soil, is estimated at 150 to 5,000 years [6]. These minerals can also enter and accumulate in the ecosystem through their accumulation in the rings of different food chains. Their access to concentrations causes harm to environmental and human consumers. It may harm the plant or animal exposed to high concentrations directly through their oxidized effects through the formation of free radicals as well as their ability to create genetic mutations that cause prominent harm, especially cancers [7-9]

The lead element is essential in the study of heavy metal air pollution. This is because it spreads in every aspect of the environment. It is very toxic if its proportion rises to a certain extent and even in the small percentages in which it is found in the atmosphere of cities, especially the high population density, which varies in modes of transport and the use of kind and the sources of pollution in this element vary. Some paints can contribute to high levels of lead, and lead can also reach the atmosphere through fumes, car exhausts, and metal melting. It was also found that some incense used frequently in homes contains high lead levels. In addition, some types of plastic bags and polyethylene used to write on them some inks containing lead up to 4.8%.

Additionally, municipal waste residues and sidewalk dust contribute significantly to providing city atmospheres with dust particles that make the air have high proportions of harmful metals, including lead [10- 12]. Lead poisoning has many risks, and symptoms range from mild to severe. And symptoms in young people dealing with lead poisoning include learning disabilities, developmental delays, and loss of appetite and weight. There are also risks associated with exposure in adults, memory loss and difficulty concentrating, headaches and migraines, mood disorders, high blood pressure, joint and muscle pain, and fertility issues (reduced sperm count or abnormal sperm in men, miscarriage, premature birth, or stillbirth in women). Lead risks also can inhibit many enzymes in the body, resulting in the inhibition of hemoglobin production. Lead affects kidney tissue, red blood cells, and the birth of dead embryos [1], [13-16]. The measurement and monitoring of air pollutants in air ambient, including lead, is an essential step in reducing this pollution. Many techniques are used to monitor air pollution, including mobile or fixed air pollution monitoring stations, to collect particles and identify their hazardous metal content [17]. Since some methods do not provide comprehensive information about the effect of these pollutants on the living components of ecosystems [18], the use of organisms, particularly plants, has become increasingly important in monitoring and assessing risks from pollution indirectly, known as biomonitoring. Vegetation is a key component of ecosystems and for easy sampling and availability. , and because vegetation has a role to play in improving air quality [19] and leaves are among the essential parts of the plant approved for biomarkers as bioindicators and bioaccumulators and the biochemical components as effective biomarkers for pollution monitoring and assessment [20-21]. Therefore, the current study is an attempt to highlight the varying capacity of plant species from shrubs and trees and vegetation to the Karkh side of Baghdad to uptake and accumulate lead and work to increase the density of the best of them within the program to control and reduce pollution levels within the city environment.

Baghdad is divided into two main sections, Karkh and Al-Rusafa, separated by the Tigris River, which is in the middle of the city. The study area is located on the Karkh side of Baghdad city. Rusafa is on the eastern side, and Karkh is on the west side, with an area of 509,600 km2, in which the study area is located, at latitude and length (33, 44) respectively, and Baghdad is in the middle of Iraq's cities north and south [23]. The five different sites were selected, presented by the following sectors, Al-Kadhimiyah (Abdul Mohsen Al-Kadhimi Square), Al-Mansour (Abu Jaafar Al-Mansour Square), Al-Salam district (Factories), Al-Adl District Intersection (Central Markets), and Al-Ghazaliya-Al-Ameriya street (Al-Seklat). And they were coded (A, B, C, D, E) respectively, as described (**Figure 1**).

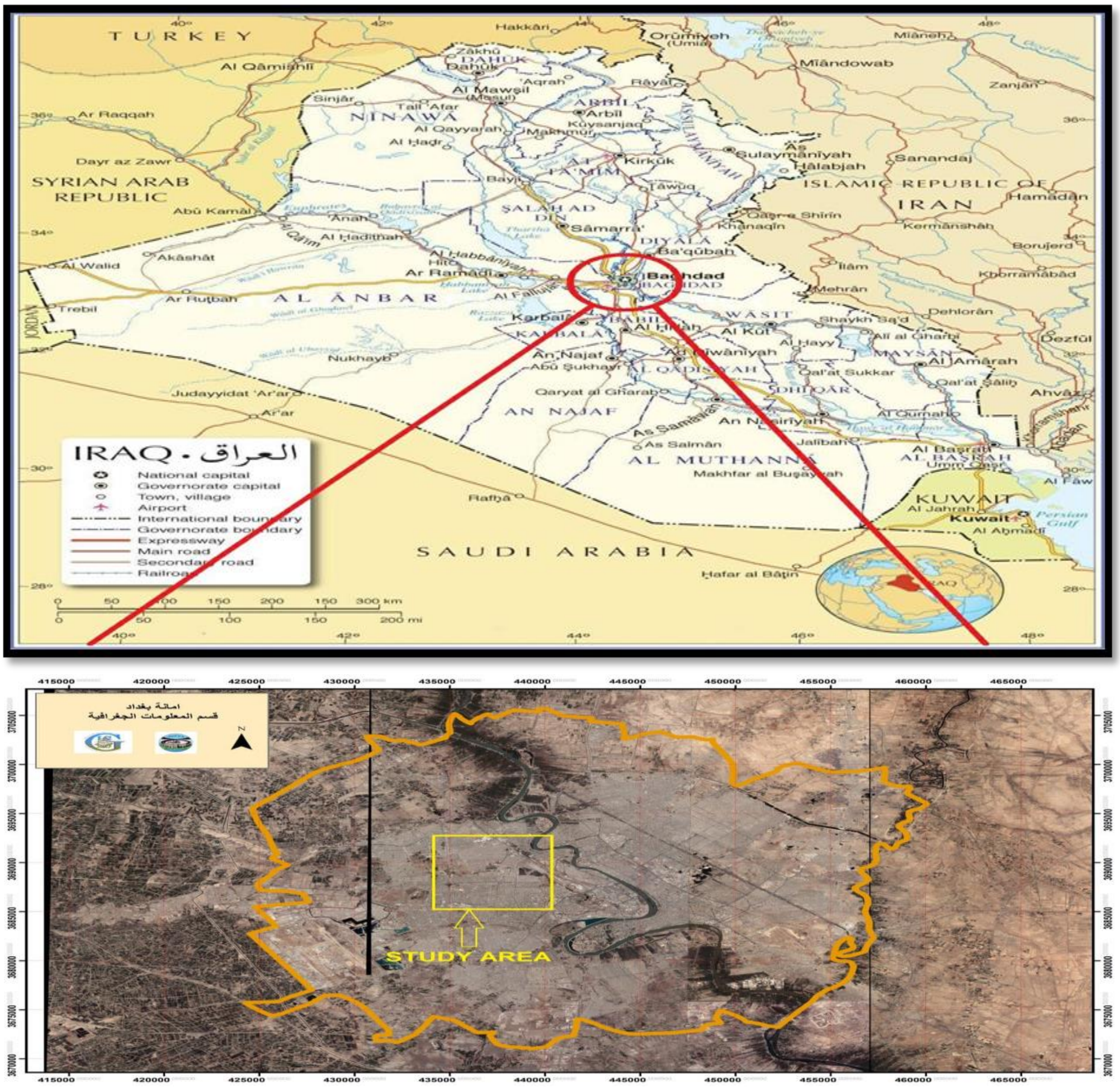

Figure 1. Map of Iraq and a Picture of the Study Area / Baghdad Karkh (GOOGLE, 2022).

2.Materials and Methods

Collection of plant leaf samples from the study sites :

The plant leaves were left to dry naturally, noting that they were not exposed to heat, humidity, or lighting at room temperature. They were milled and then sifted with a delicate sieve and prepared plant samples to detect lead from leaves. The steps mentioned in [24] were followed as follows:

(2) dry g of powdered leaves of each type of plant for the plant sample under study was weighted. This amount was placed in a glass beaker and add (40) mg of concentrated nitric acid (HNO3), and cover with a class watch and leave for a whole night. The beaker with the class watch placed on a heated heater (105°C) and continue to heat the mixture until the fumes appear,

then it was cooled the model above and add (3) mg of concentrated $HClO_3$. The beaker was repositioned on the heating heater. The glass watch was removed from the beaker's nozzle and heated cautiously until the mixture dries. The sample was cooled and add (2) mg of concentrated (HCl) and (3) mg of distilled water. The sample was repositioned on the heater at a low temperature (75°C), left to cool, filtered into a bottle of (25) mg, and complimented the size with water distilled to the mark.

3.Results and Discussion

Accumulation of lead in plants

It is essential to show that the accumulation of lead on plant leaves causes damage to these plants, humans, and the environment in general and should not exceed the allowable limit (0.3 ppm), according to [26]. When measuring lead concentrations in plant leaf samples, it was found to vary depending on the type of plant and study location. The plant species whose accumulated lead concentration was detected on their leaves were: (Conocarpus lancifolius, Ziziphus spina christi, Albizia lebbeck, Eucalyptus sp., Nerium oleander, Dodonaea viscosa, Phoenix dactylifera, Olea europaea, Myrtus communis, Ficus nitida, and Citrus aurantium); per sample taken from the sites under study (A, B, C, D, E) and the results of measurement experiments in five different sites were:

1. **Lead concentration at the first study site (A):**

At site (A) in Al-Kadhimiyah area (Abdul Mohsen Al-Kadhimi Square): the results showed that the concentration of lead for plants (Conocarpus lancifolius, Ziziphus spina christi, Albizia lebbeck, Eucalyptus sp., Nerium oleander, Dodonaea viscosa, Phoenix dactylifera, Olea europaea, Myrtus communis, Ficus nitida, Citrus aurantium) were (0.46, 0.56, 0.36, 0.55, -, 0.68, -, -, 0.33, 0.29, 0.84) ppm respectively. The results note that the highest lead concentration on plant leaves was in the Citrus aurantium plant by (0.84) ppm. In contrast, the lowest value of lead concentration was in Ficus nitida plant by (0.29) ppm, as shown in **Table (1)**.
It was noted that the concentration of lead exceeded the relatively permissible limit of (0.3) ppm, except Ficus nitida plant (0.29) ppm was within the allowable limit. Al-Kadhimiyah area is considered a commercial area due to the presence of many shops and furnaces used in the operation of some oil derivatives. In addition to that, the plant sample was taken from a principal public square. The increased lead concentration in these sites is the high traffic density in this area.

Table 1. Lead concentrations in plant species leaves at site (A) in ppm unit.

Plant species	**Lead concentration**
Conocarpus Lancifolius	.046
Ziziphus Spina Christi	0.56
Albizia Lebbeck	0.36
Eucalyptus Sp.	0.55
Nerium Oleander	ND
Dodonaea Viscosa	0.68
Phoenix Dactylifera	ND
Olea Europaea	ND
Myrtus Communis	0.33
Ficus Nitida	0.29
Citrus Aurantium	0.84

2. Lead concentration in the second site (B):

At site B, which is located in Al-Mansour area (Abu Jaafer Al-Mansour Square), the results showed that the concentration of lead for plants (C.lancifolius, Z.spina christi, A.lebbeck, Eucalyptus sp., N.oleander, D.viscosa, P.dactylifera, O.europaea, M.communis, F.nitida, and C.aurantium) were 0.74, BDL, 0.25, 0.57, -, 0.16, -, -, 0.31, - ppm respectively. These results showed that the highest concentration of lead accumulated on plant leaves at this site was in the C.lancifolius plant by (0.74) ppm, in contrast to the lower value of the concentration of lead in

P.dactylifera by (0.16) ppm and shown in **Table (2)**. Lead concentration was found to have exceeded the relatively permissible limit of (0.3) ppm except for Z.spina christi, A.lebbeck, and P.dactylifera (BDL, 0.25, 0.16), respectively. The reason for the increase in the concentration of lead at this site is the proximity of the site to the main commercial centers (malls). There are many shops, ovens, restaurants, suffocating traffic jams, and a large number of generators and schools in this area. Also, it is because many shops and bakeries use some oil derivatives in addition to the proximity of the study site to a central public square (Abu Jaafar Al-Mansour Square).

Table 2. Lead concentrations in plant species leaves at site (B) in ppm unit.

Plant species	Lead concentration
Conocarpus Lancifolius	0.74
Ziziphus Spina Christi	BDL
Albizia Lebbeck	0.52
Eucalyptus Sp.	0.57
Nerium Oleander	ND
Dodonaea Viscosa	ND
Phoenix Dactylifera	0.16
Olea Europaea	ND
Myrtus Communis	ND
Ficus Nitida	0.31
Citrus Aurantium	ND

3. Lead concentration in the third site (C):

While at the study site (C) located in the Al-Tubji area (industrial district), the results showed that the concentration of lead for the plants under study (C.lancifolius, Z.spina christi, A.lebbeck, Eucalyptus sp., N.oleander, D.viscosa, P.dactylifera, O.europaea, M.communis, F.nitida, and C.aurantium) reached (0.95, 0.65, 0.832, 0.831, 0.86, 1.02, -, -, 0.436, -, 0.532) ppm respectively. The results showed that the most significant value of the concentration of lead accumulated on the plant leaves at this site was in the D.viscosa plant by (1.02) ppm, in contrast to the lower value of the lead concentration in M.communis plant by (0.463) ppm as shown in **Table (3)**. In the results, the lead concentration has exceeded the relatively permissible limit of (0.3) ppm. This is due to the increase in the lead concentration at this site. The site's proximity to industrial production plants is characterized by high emissions, and also close to the railway line and main street (airport highway), the large shops, high traffic density, and a large number of generators in this area, depending on oil derivatives.

Table 3. Lead concentrations in plant species leaves at site (C) in ppm unit.

Plant species	Lead concentration
Conocarpus Lancifolius	0.95
Ziziphus Spina Christi	0.65
Albizia Lebbeck	0.832
Eucalyptus Sp.	0.831
Nerium Oleander	0.86
Dodonaea Viscosa	1.02
Phoenix Dactylifera	ND
Olea Europaea	ND
Myrtus Communis	0.436
Ficus Nitida	ND
Citrus Aurantium	0.532

4. Lead concentration in the fourth site (D)

As for the study site (D), which is located near the intersection of Al-Adl district on the international highway, the results showed that the concentration of lead for the plants studied (C.lancifolius, Z.spina christi, A.lebbeck, Eucalyptus sp., N.oleander, D.viscosa, P.dactylifera, O.europaea, M.communis, F.nitida, and C.aurantium) were (0.34, 0.95, 0.48, 0.40, -, 0.19, -, -, -, -, -, -) ppm respectively. The results note that the highest concentration of lead accumulated in this site on plant leaves was in the Z.spina christi plant by (0.95) ppm, while the lowest value of lead .(concentration was in the D.viscosa plant by (0.19) ppm, as shown in Table (4

Our results showed that the lead concentration exceeded the permissible limit of (0.3) ppm except for the P.dactylifera plant, which was within the limit of (0.19) ppm. The increased lead concentration at this site is due to the site's proximity to the highway (Baghdad-Amman) and the traffic density resulting from the continuous transport of vehicles, trucks, and other various means of transportation.

Table 4. Shows lead concentrations of plant species on site (D) in ppm unit.

Plant species	Lead concentration
Conocarpus Lancifolius	0.34
Ziziphus Spina Christi	0.95
Albizia Lebbeck	0.48
Eucalyptus Sp.	0.40
Nerium Oleander	0.53
Dodonaea Viscosa	ND
Phoenix Dactylifera	0.19
Olea Europaea	ND
Myrtus Communis	ND
Ficus Nitida	ND
Citrus Aurantium	ND

5. Lead concentration in the fifth site (E):

Finally, the site (E), which is located on the main street between the areas of Al-Ghazaliya and Al-Ameriya, the results of the current study showed that the concentration of lead for the plants under study (*C.lancifolius*, *Z.spina christi*, *A.lebbeck*, *Eucalyptus* sp., *N.oleander*, *D.viscosa*, *P.dactylifera*, *O.europaea*, *M.communis*, *F.nitida*, and *C.aurantium*) had reached the concentrations (0.48, 0.50, 0.49, 0.41, -, -, -, 1.45, -, -, -) ppm respectively. These results showed that the highest concentration of lead accumulated at this site on plant leaves was in *O.europaea* plant by (1.45) ppm, while the lowest value of lead concentration was in *Eucalyptus* sp. plant by (0.41) ppm and shown in **Table (5).** The result we obtained showed that the concentration of lead exceeded the relatively permissible limit of (0.3) ppm and the increased concentration of lead at this site is due to the proximity of the site to the highway (Baghdad-Amman) on the one hand and on the other near the site from the street adjacent to the site of the main centers (Al-Seklat) dedicated to the sale of construction materials on the public street and the traffic intensity resulting from the continuous transportation of vehicles and trucks carrying these materials and various other means of transportation.

Table 5. Lead concentrations in the leaves of plant species on site (E) in ppm unit.

Plant species	Lead concentration
Conocarpus Lancifolius	0.48
Ziziphus Spina Christi	0.50
Albizia Lebbeck	0.49
Eucalyptus Sp.	0.41
Nerium Oleander	ND
Dodonaea Viscosa	ND
Phoenix Dactylifera	ND
Olea Europaea	1.45
Myrtus Communis	ND
Ficus Nitida	ND
Citrus Aurantium	ND

The results of the statistical analysis showed significant differences ($P \leq 0.05$) in all the sites under study between lead concentration rates and plant species and showed a non-significant positive correlation between lead concentration and temperature rates of (0.14), a non-significant relationship of lead concentration with humidity of (0.07) and non-significant negative relationship with wind speed (-0.13). When comparing the above five sites, we found that the highest lead concentration was recorded at the study site (E) in the Area of Al-Ameriya (1.45 ppm for *O.europaea* plants) to contain the site on sources of pollution from commercial centers for the sale of construction materials and materials, used in construction and much traffic in the street adjacent to the site. Still, the least concentration of lead was at the study site (B) in Al-Mansour area by (0.16) ppm for P.dactylifera due to a lack of sources of pollution. Sites (A, C, D) have not been without some sources of pollution, such as long-running generators and highways with continuous traffic density. Here we can say that there is often a relative rise in the concentration of lead accumulated on plant leaves at all the study sites. This increase is due to the increased density and traffic of cars, and cargo vehicles in the areas specified for the study and the spread of electric power generators, which led to the accumulation of lead emitted [27].

Concentration of lead in recurring plants at study sites:

The study found that plant species differed in appearance or presence at the five study sites. Plants (C.lancifolius, Z.spina christi, Eucalyptus sp., A.lebbeck) may re-emerge when comparing lead concentration rates in recurrent species (C.lancifolius, A.lebbeck) for all the study sites. The highest lead concentration rate is for the C.lancifolius plant, which recorded (0.594 ppm). The lowest rate is for the Z.spina christi plant, which recorded (0.532) ppm. The concentration rate of the element in the plant (A.lebbeck, Eucalyptus sp.) ranged from (0.536 and 0.552) ppm, respectively. This difference in rates depends on the type of plant and nature of the source of pollution, accumulated elements, their quantity, and human activity at the study site. This variation in the concentration rates of the lead component is based on quality, density, some individuals of these plants, and the way they are distributed. It is also based on the number of species, individuals of vegetation cover as a whole, and other environmental factors affecting the process and activity of each plant. **Table (6)** shows this variation in the capacity of accumulation and uptake of the contaminated element. **Figure (3)** shows the effect of the site and plant type on lead concentration.

Table 6. Lead concentrations and rates in recurring plants at ppm study sites.

Type of plant	Site A	Site B	Site C	Site D	Site E	Mean
C.lancifolius	.046	0.74	0.95	0.34	0.48	0.594
Z.spina christi	0,56	BDL	0.65	0.95	0.50	0.532
A.lebbeck	0.36	0.52	0.832	0.48	0.49	0.536
***Eucalyptus* sp.**	0.55	0.57	0.831	0.40	0.41	0.552

We also found the percentage of lead accumulation of plant species under study from previous results. **Table (7)** and **Figure (2)** showed the percentage of plant species (C.lancifolius, Z.spina christi, A.lebbeck, Eucalyptus sp.) were (27%, 24%, 24%, and 25%, respectively). In comparison, we found that the highest percentage recorded was 27% for the C.lancifolius plant and the lowest value was for the Z.spina christi and A.lebbeck plants. The statistical analysis results showed that there were non-significant differences in all sites except site (D). The results showed a non-significant positive correlation between the concentration of lead and temperature rates and its value (0.14), the existence of a non-significant correlation relationship with humidity of (0.07), and a non-significant negative with the wind speed rate of (-0.13).

Table 7. Shows the percentage of lead accumulation in plant species.

Type of plant	Mean	Percentage
C.lancifolius	**0.594**	**27 %**
Z.spina christi	**0.532**	**24 %**
A.lebbeck	**0.536**	**24 %**
***Eucalyptus* sp.**	**0.552**	**25 %**

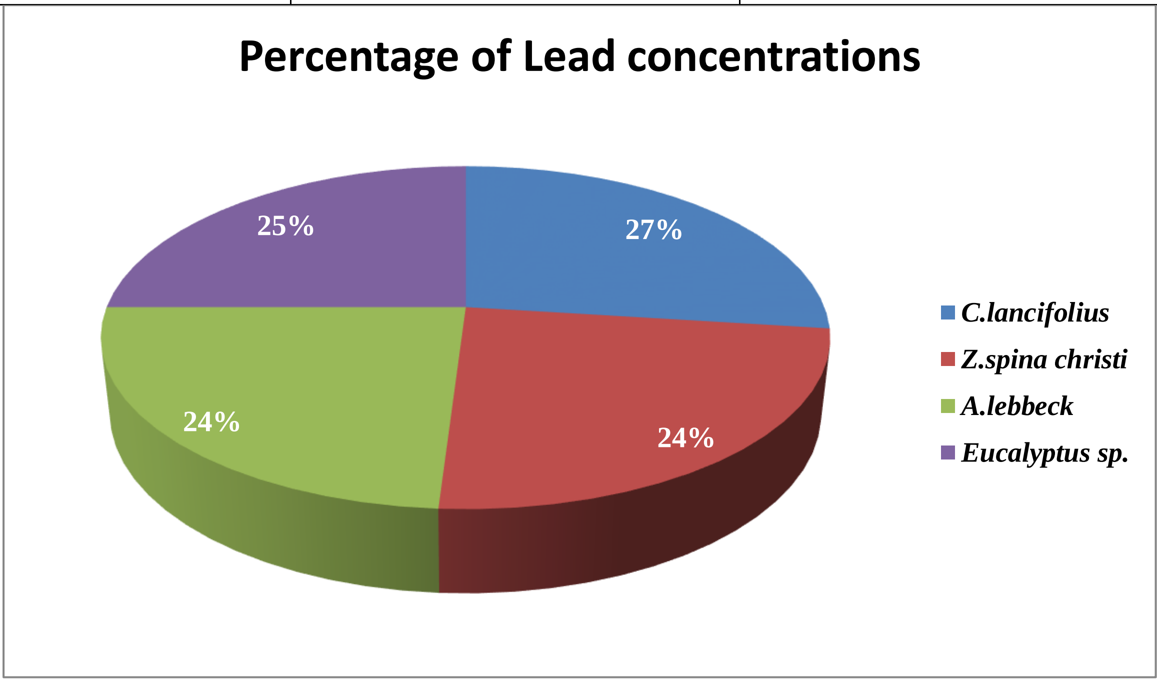

Figure 2. Shows the percentages of lead accumulation in plant species.

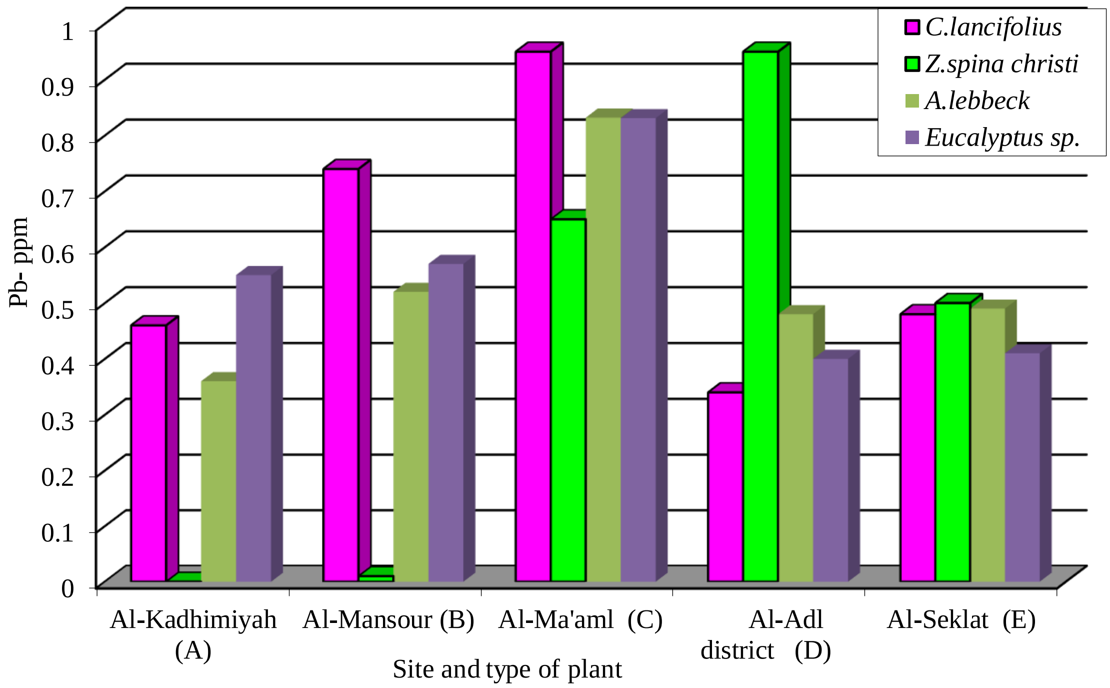

Figure 3. Effect of the site and plant type in the concentration of lead and its rates in recurrent plants

4.Conclusions

1. It was noted that the lead concentration for plant levels in Baghdad had exceeded the limits allowed nationally in some areas of the industrial district and Al-Seklat. Still, the lead concentration in this study was less than in previous years due to the lack of industrial events that have a role in increasing the lead concentration in the air.
2. The plants' leaves showed a variation in their ability to accumulate lead where the results differed. The O.europaea leaf at the Al-Seklat site observed a high lead concentration.
3. The O.europaea plant is one of the most accumulated plants of the lead element, and the P.dactylifera plant is the least accumulated, for non-recurring species, while the recurrent plant (C.lancifolius) is the most accumulated. In contrast, the plant (Z.spina christi) is the least accumulated. They can be used as environmental banks and green belt formations to reduce the concentration of pollutants.

References

1. Donahue, N.M. Green Chemistry in Practice: Air Pollution and Air Quality. **2018**,151-179.

2. Burroughs Peña, M S.; Rollins, A. Environmental Exposures and Cardiovascular Disease A Challenge for Health and Development in Low- and Middle-Income Countries. *Cardiol. Clin.*, **2017**, *35*, 71-86 .

3.Mannucci, P. M.; Franchini, M. Health Effects of Ambient Air Pollution in Developing Countries. *Int. J. Environ. Res. Public Health*, **2017**, *14*, 9, 1048

4. WHO. 7 million deaths annually linked to air pollution. Cent. Eur. *J. Public Health*, **2014**, *22*, 53–59.

5.Zhang, M; Pu, J. (2011). Mineral materials as feasible amendments to stabilize heavy metal in polluted urban soils. *J. Environ. Sci.*, **2011**, *23(4)*, 607-615.

6. Saxena, P. K., Krishnaraj, S., Dan, T., Perras, M. R., and Vettakkorumakankav, N. N. Phytoremediation of heavy metal contaminated and polluted soils, in Heavy Metal Stress in Plants: From Molecules to Ecosystems, eds M. N. V. Prasa and J. Hagemeyer (*New York: Springer*). **1999**, 305–329.

7.Baudouin, C.; Charveron, M.; Tarroux R.; Gall, Y. Environmental pollutants and skin cancer. *Cell Biol. Toxicol.*, **2002**, *18, 5*, 341–348.
8. Radulović, M.; Stanković, S.; Simić, Z.; Radaković, M. and Topuzović, M.The accumulation of metals in *Polygonum aviculare* L. in area of the Kraljevo city. *Kragujevac J. Sci*., **2014**, *36*, 175–184.
9. Aljewari , A.F.M.; Al-Salman, I.M.A (2022). The effect of human activities in the installation and quality of street dust components in Baghdad city (Applied study in Al-Zafaraniyah sector). Cincinnati, OH, United States,11th -12th April. **2022**, AIP Conference Proceedings (ISSN:0094-243X). Accepted.
10.Khayoon, N.A.; Al-Salman, I.M.A. Variation in ability of recurring plants species in the vegetation to deposit dust in the atmosphere of Baghdad City (applied study in Al-Kurkh site). Cincinnati, OH, United States,11th -12th April. **2022**, AIP Conference Proceedings (ISSN:0094-243X). Accepted.
11. Alhesnawi, A.S.; Al-Salman, I.M.; Najim, A. N. Some physical and chemical characteristic of dust falling on Karbala city-Iraq. *J. Eng. Appl. Sci*., **2019**.14(Speci, issue 6), 9340-9344.
12. Saeed, M.; Abu Talib, A.; Al Thuwaini, M.N.; Kazem, A.H.; Al-Salman, I.M . Contribute to cleaning the environment by converting waste tires and rubber into rubber polymers. 4th Intern, Confer of the Society for the Protection of Genetic and Environmental Resources, 23-30/7/2016, Arab Republic of Egypt, **2016**, Conf, Proce, Book, 480-489.
13.Jacob, J.M.; Karthik, C.; Saratale, R.G.; Kumar, S.S.; Prabakar, D.; Kadirvelu , K.; Pugazhendhi, A. Biological approaches to tackle heavy metal pollution: A survey of literature. J. Environ. Manag., **2018**, *217*, 56-70.
14.Zak, L. The Long-Term Effects of Lead on Human Health. Zota Professional training, Sept, 24, **2020**. 5701Shingle Creek Parkway, Suite 500k, Brooklyn Center, MN554305
15.Kumar, A ; Cabral-Pinto M.M.S. ; Ashish K. C.; Aftab A.; Shabnam, A.A; Subrahmanyam , Mondal, G.; Gupta, D.K.; Malayan, S.; Kumar, S.S.; Khan, S.A.; Yadav, K.K. Lead Toxicity: Health Hazards, Influence on Food Chain, and Sustainable Remediation Approaches. *Int. J. Environ. Res. Public Health.* **2020**, *17*, 7, 2179.
16.Zak, L. The Long-Term Effects of Lead on Human Health. Zota Professional training, Sept, 24, **2020**. 5701Shingle Creek Parkway, Suite 500k, Brooklyn Center, MN554305.
17.Ghelich, S.; Zarinkamar, F.; Niknam, V. Determination of Peroxidase Activity, Total Phenolic and Flavonoid Compounds Due to Lead Toxicity in *Medicago sativa* L. *Adv. Environ. Biol.* **2012**, *6*, 8, 2364-2012.
18.Ristić, M.; Perić-Grujić, A.; Antanasijević, D.; Ristić, M.;Urošević, M. A. & Tomašević, M.. Plants as monitors of lead air pollution. *Pollutant Dis. Remed. Recycl*. **2013**,*4*, 387-431.
19.Norouzi, S. and Khademi, H. Source identification of heavy metals in atmospheric dust using *Platanus orientalis* L. leaves as bioindicator. *Eurasian J. Soil Sci*., **2015**, *4*, 3, 144-152.
20.Ali, M.; Singh, N.; Shohael, A.; Hahn, E.; Paek, K.-Y. Phenolics metabolism and lignin synthesis in root suspension cultures of *Panax ginseng* in response to copper stress. *Plant Sci*. **2006**, *171, 1*, 146-154.
21.Louis, H.; Maitera, O.N.; Boro, G and Barminas, J.T. Determination of Total Phenolic Content and Some Selected Metals in Extracts of *Moringa oleifera*, *Cassia tora*, *Ocimum gratissimum*, *Vernonia baldwinii* and *Telfairia occidentalis* Plant Leaves. *World News Nat. Sci*. **2017**, *11*, 11-18.
22.Amanat Baghdad. Department of Designs / Department of Jeffery Information). **2022**.
23.Jawad, M.; Sousse, A. Baghdad Map Guide, First Edition - Al-Alamy Press.**1958**, Baghdad, Iraq.
24.Haswell, S. J. Atomic absorption spectrometry.**1991**,529.
25.JADIA, C.D. & FULEKAR, M.H. Phytoremediation of heavy metals;Recent Techniques. *African Journal of Biotechnology*, **2009**, *8(6)*,921-928.
26.Codex Alimentarius, C. General standard for contaminants and toxins in food and feed. Codex stand. **2017**, 193-1995. World Health Organization.

27.Ali, M.H.; Al-Qahtani, K.M. Assessment of some heavy metals in vegetables, cereals and fruits in Saudi Arabian markets. *Egypt. J. Aquat. Res.***2012**, *38, 1*, 31-37.