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Heavy Metals Accumulation in Two Types of Tree Leaves from Baghdad Urban Areas

Abstract- It is well known that environmental pollution by many heavy metals is a serious problem to the natural ecosystem due to their toxic effects. Most heavy metals such as Cu, Mn, Fe, and Zn are needed by various organisms but at certain concentrations is very necessary for both plants and animals. However, it has been suggested that ever green plant trees can assist in controlling such pollution via various methods where one method is the ability of these plant trees to absorb heavy metals from contaminated soils. The current work was designed to assess Cd, Mn and Pb plant content in two tree species (*Eucalyptus* sp. and *Albizia* sp.) collected from Tourist Baghdad Island (TBI) situated in Al-Fh'hama region. It seems very obvious that these examined trees can be regarded as certain heavy metals eliminator where eucalyptus tree has shown considerable ability in removing all examined heavy metals which were significantly higher than that of Albizia trees.

Keywords- TBI, *Eucalyptus*, *Albizia* sp., Soil pollution, Heavy metals.

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1. Introduction

The contamination of the natural environment with heavy metals is a global problem because these metals are permanent and [1]. The toxicity of minerals is usually defined in terms of the desired concentration. Predicting the consequences of exposure to organisms is complicated because these minerals may be necessary or non - essential in the small amount [2]. It is known that many minerals like heavy elements in the soil are usually found at low levels but due to pollution resulting from various human activities and natural disasters [3]. It is better to measure the content of plants of these toxic and hazardous elements (Pb, Cu, Cd and Hg) due to the ability to be accumulated and building higher concentrations to be very toxic which leading to a serious effects not only on plants but also on human health where lead, for example, may cause lethal diseases such as Pyelonephritis, Osteomolica, cancer and renal tumors [4]. It is well known that the primary source of lead in the environment is mainly the various human activities that may release lead due to the combustion of leaded petrol, which generates and releases lead into the environment. Lead is transported by air. The source of lead is found in soil, water, and soil through natural and physiological processes such as weathering, erosion, rain, and dry dust deposition

[5,6]. In addition, cadmium ions seem to be very toxic once accumulated in biological tissues. ite this metal has no clear function in various plant and animal species. However, it has been reported that its critical content ranges from 3–5 mg/ kg [7] but certain soils have a range of 5 -10 mg/kg . On the other hand, manganese is very known as a very necessary metal for both plant and animal growth, but it also has critical content ranging from 300 to 500 mg/kg while several soils have much higher Mn content, which varied from 1500 up to 3000 mg/kg [8]. The current study was designed to examine certain heavy metal content such as Mn, Cd, and Pb in soil samples collected from beneath several trees of both *Eucalyptus* sp. and *Albizia* sp. species and also in leaves of these tree species.

2. Material and Methods

The Tourist Island of Baghdad is an island at the tip of the northern city of Baghdad and situated adjacent to the Tigris River Figure 1. It is 20 km away from Baghdad center and covers about 220.000 m² (2000 m long and 110 m. wide) forming an oval shape. It was found during 1983 as social entertainment theme [9]. The theme was significantly deteriorated after 2003 and went out of service, but in 2016, the island was referred to the privet investment [9].



Figure1: Satellite image of Baghdad Tourist Island location

The samples were selected from the previous two types of dominant and semi-dominant trees and the distance [4, 1] between the sample and the other 10 meters. Forty soil samples were taken at a depth of 30 cm (20 samples from under Eucalyptus sp. Trees and other 20 samples from beneath Albizia sp. trees. In addition, the leaves from both tree species were collected. The leaves were cleaned and air-dried under lab conditions [10]. Each sample of both soil and leaves was grinded and passed through 2mm stainless steel sieve twenty tree plants from both species in each testing site were randomly selected and subjected to the current work. All examined plants were apart from each other about 10 m. Soil a depth of 30 cm and green leaves samples were collected from each plant. Each soil sample was dried under lab

temperature and gently grinded and sieved using 500 mm stainless steel sieve. 0.5 g of each sample was digested using 3 mL of HNO₃ and 2 mL of HCl mL and filtered using 0.45 Whatman filter paper and Cd, Mn and Pb soil content of each sample were recorded by AAS as suggested by [10]. A similar technique was followed for plant leaves samples to evaluate their heavy metals content where 2 gm from each dried leaf sample was tested for these heavy metals content.

3. Results and Discussion

I. Soil Heavy metal content

Mean Soil heavy metal content (mg/kg) of Mn, Cd and Pb in 20 soil samples from beneath examined tree species was given in Table 1.

Table 1: Mean Soil heavy metals content (mg/kg) of Mn, Cd and Pb in examined 20 soil samples

Sample	Mean Soil heavy metal content (mg/kg)					
	Mn		Cd		Pb	
	Eucalyptus sp.	Albizia sp.	Eucalyptus sp.	Albizia sp.	Eucalyptus sp.	Albizia sp.
1	1424.1	2781	10.6	8.2	30.06	23.535
2	2119.9	2343.7	15.45	7.5	27.615	15.37
3	753.45	1172.5	12.8	7.5	34.145	20.27
4	1737.3	1446.65	16.9	10.15	33.055	17.82
5	1004.2	1177.7	17.4	8.7	33.275	35.775
6	2532	1261.85	19.3	8.7	30.88	24.075
7	1438	1284.4	16.15	12.3	35.23	17.55
8	1391.15	1261	18.35	9.4	33.87	20.27
9	1103.95	754.35	10.6	15.95	35.23	24.62
10	1064.9	1562.05	19.8	12.55	40.945	25.71
11	1781.55	1172.5	13.5	15.7	39.31	19.725
12	2554.55	1402.75	15.45	16.65	29.79	36.59
13	1614.1	1295.7	17.6	19.8	39.04	18.635
14	1313.05	1392	21	23.4	38.495	27.885
15	1218.5	1236.7	16.65	24.6	29.52	24.62
16	1262.75	2781	21.7	22.95	27.34	31.15
17	1545.55	2343.7	20.5	22.7	37.135	37.41
18	1588.95	1172.5	19.05	28.5	34.145	25.435
19	1495.25	1446.65	9.65	21.7	36.865	34.415
20	1424.1	1177.7	20.75	5.2	30.06	23.535

a. Mn ions. It has been found that soil samples of both tree species had different Cd content and varied from 1004.2 (mg/kg) to 2554.55(mg/kg) and from 1172.5(mg/kg) to 2343.7(mg/kg) for Eucalyptuses and Albizia plants respectively Figure 1.

b. Cd ions. It has been found that soil samples of both tree species had different Cd content and varied from 9.65 mg/kg to 21.7 mg/kg and from 7.5 mg/kg to 28.5 mg/kg for Eucalyptuses and Albizia plants, respectively (Figure 2).

c. Pb ions. It had been found that soil samples of both tree species had different Cd content and varied from 27.615 mg/kg to 40.945 mg/kg and from 15.37 mg/kg to 36.59 mg/kg for Eucalyptuses and Albizia plants, respectively, Figure 3.

II. Trees heavy metal content

Mean Soil heavy metals concentration (mg/kg) of Mn, Cd and Pb in 20 soil samples from beneath examined tree species was given in Table 2.

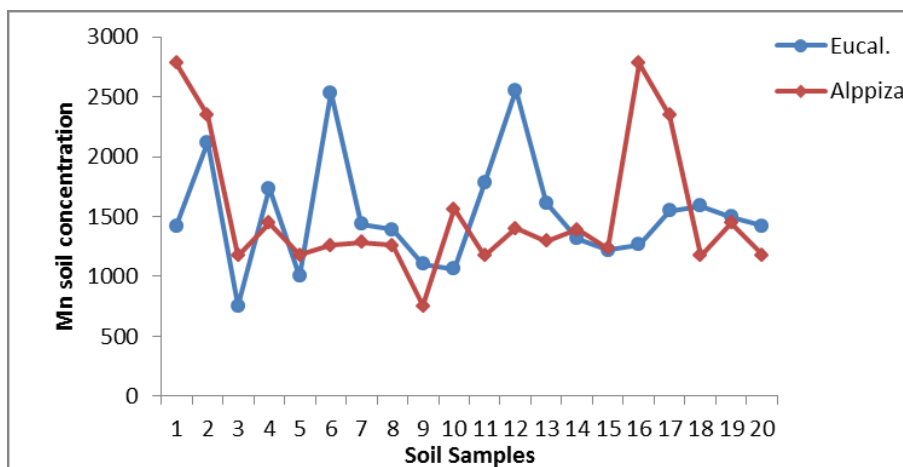


Figure 1: Mn concentration (mg/kg) in 20 soil samples of two trees species

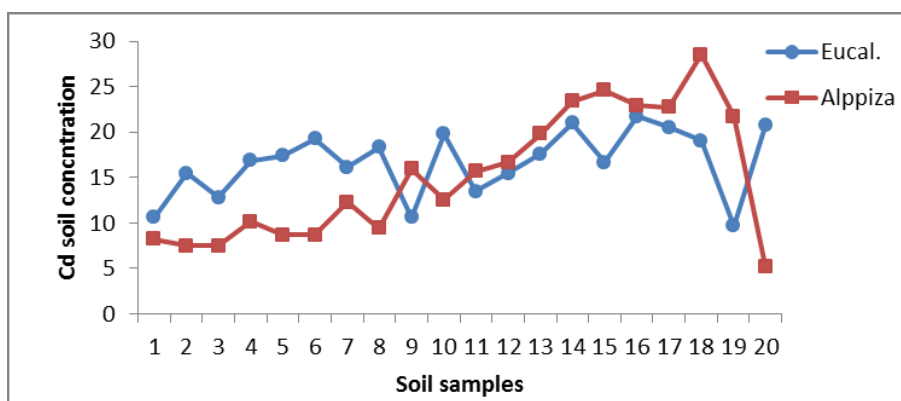


Figure 2: Cd concentration (mg/kg) in 20 soil samples of two trees species

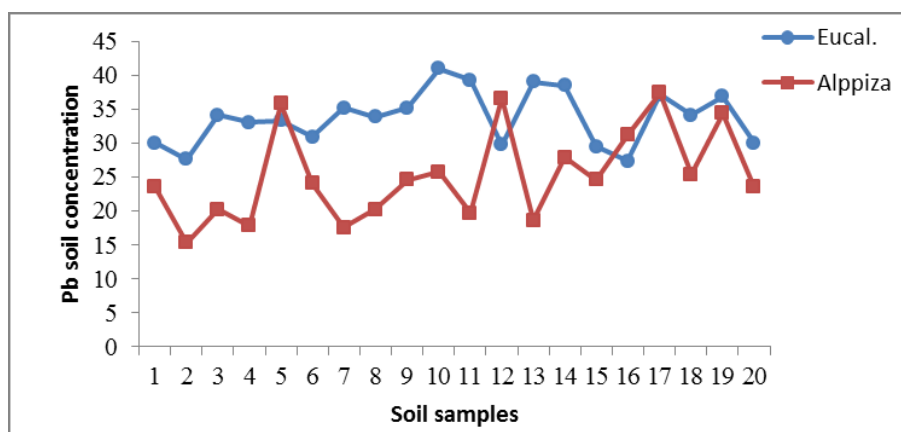


Figure 3: Pb content (mg/kg) in 20 soil samples of two trees species

Table 2: Mean plant heavy metals content (mg/kg) of Mn, Cd and Pb in examined 20 soil samples

Sample	Mean Soil heavy metal content (mg/kg)					
	Mn		Cd		Pb	
	<i>Eucalyptus sp.</i>	<i>Albizia sp.</i>	<i>Eucalyptus sp.</i>	<i>Albizia sp.</i>	<i>Eucalyptus sp.</i>	<i>Albizia sp.</i>
1	63.77	61.965	0.625	0.75	50.35	ND
2	46.995	20.525	1.47	0.95	88.4	ND
3	61.6	3.38	1.945	0.65	17.7	ND
4	159.31	14.59	1.445	0.775	77.55	ND
5	54.08	70.425	1.445	1.125	20.4	69.35
6	75.125	15.39	1.245	1.195	12.25	20.4
7	83.445	37.155	0.925	1.445	77.55	14.95
8	140.145	96.175	1.77	1.67	53.05	ND
9	125.61	49.74	1.845	1.545	20.4	ND
10	100.295	59.36	2.27	1.17	63.95	ND
11	49.815	103.335	0.001	1.075	96.6	58.8
12	84.745	100.225	0	1.27	61.2	ND
13	130.455	72.67	0	0.575	110.2	23.1
14	68.69	92.485	0	0.35	55.75	17.7
15	58.42	89.445	0	0.475	145.55	ND
16	322.98	61.965	0.55	1.345	61.2	ND
17	130.02	20.525	0.625	1.42	66.65	61.2
18	85.54	3.38	0.8	1.57	118.36	23.1
19	119.1	14.59	0.575	1.27	72.1	ND
20	63.77	70.425	0.85	0.7	80.25	ND

a. Mn ions. It has been found that plant samples of both tree species had different Cd content and varied from 46.995 mg/kg to 322.98 mg/kg and from 3.38 mg/kg to 103.335 mg/kg for Eucalyptuses and Albipiza plants, respectively, Figure 4.

b. Cd ions. It has been found that plant samples of both tree species had different Cd content and varied from 0.0 mg/kg to 1.945 mg/kg and from 0.35 mg/kg to 1.570 mg/kg for Eucalyptuses and Albizia plants respectively Figure 5.

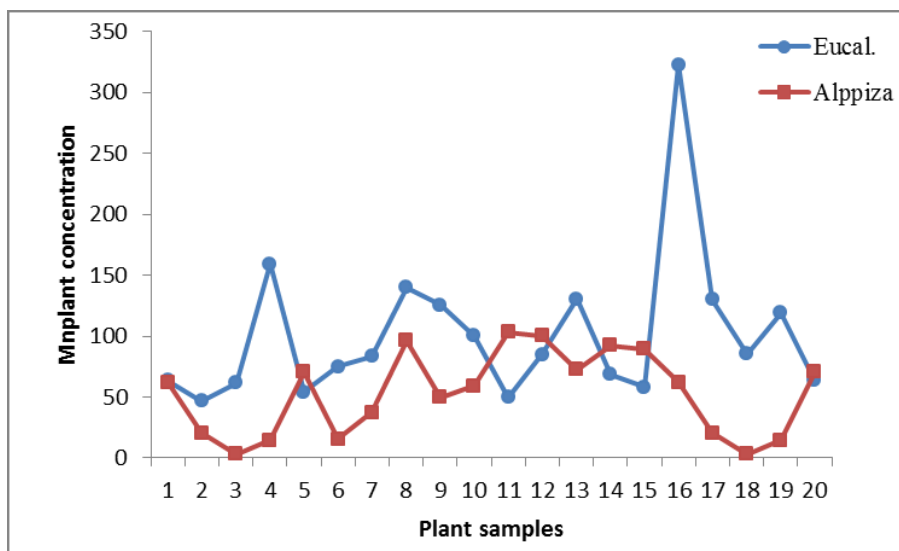


Figure 4: Mn concentration (mg/kg) in 20 plant samples of two trees species

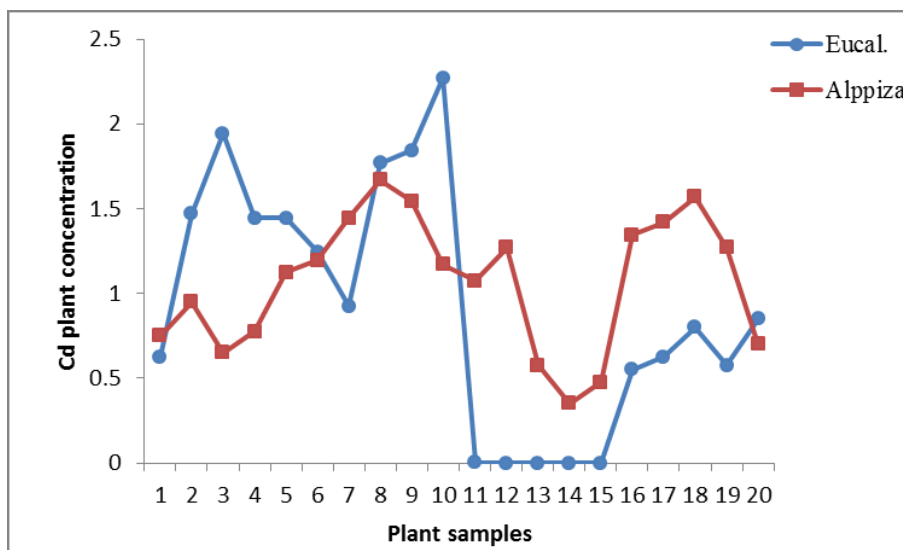


Figure5: Cd concentration (mg/kg) in 20 plant samples of two trees species

c. Pb ions. It has been found that soil samples of both tree species had different Cd content and varied from 0.0245 mg/kg to 0.1938 mg/kg and

from 0.0 mg/kg to 0.1387 mg/kg for Eucalyptuses and Albizia plants respectively Figure 6.

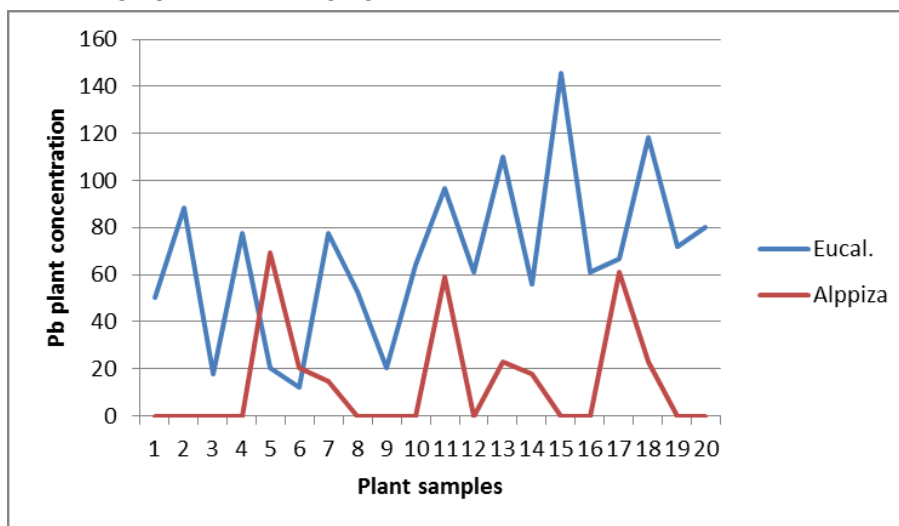


Figure 6: Pb concentration (mg/kg) in 20 plant samples of two trees species

In general, various studies have reported similar findings in such tree plants where similar work has found copper, manganese, cobalt, zinc and chromium but at lower concentrations [11] and other study carried out in Turkey [7] has found accumulated concentrations of chromium, arsenic, cadmium, mercury and lead in leaves, stem and root of invasive submerged macrophyte. However, other work [13] has examined the impact of adding lead and cadmium to growing solution of two cultivars of mung bean and mineral accumulation and reported that such heavy metals had reduced calcium biosorption.

4. Conclusion

In general, it is very obvious to conclude that these examined trees (Eucalyptus and Albizia species) can be regarded as certain heavy metals eliminator

where the tree has shown considerable ability in removing all examined heavy metals which were significantly higher than that of the Albizia sp.

References

[1] F. Nasehif, M. Monavari, G. Naderi, M.A. Vaezi, F. Madani, "Investigation of heavy metals accumulation in the sediment and body of carp fish in Aras River," *Iranian Journal of Fisheries Sciences*, Vol. 12, No. 2, pp. 398-410 2013.

[2] L.S. Khadim, G.A. Zrak, "Study of soil," *Tikrit Journal of Pure Science*, Vol. 18, No. 5, pp. 264-271, 2013.

[3] N.O. Omaka, I.F. Offor, R.C. Ehiri, "Fe, Pb, Mn, and Cd concentrations in edible World Academy of Science, Engineering and Technology," *International Journal of Agricultural and Biosystems Engineering*, Vol. 8, No.1, 2014.

- [4] D.M. Al-Daoudi, "Classification of forest trees in Iraq," University of Mosul Press, 1979.
- [5] M.N. Joan, "Assessment of heavy metal concentration in the environment and perceived health risks by the community around kadhodeki dumpsite," Nairobi, Kenyatta University, 2013.
- [6] B.A. Mustapha, D. Kubmarawa, M.H. Shagal, A. Hayatudeen, "Heavy metal profiles of medicinal plants found within the vicinity of Quarry site in Demsa," *British Journal of Applied Science & Technology*, Vol.13, No. 1, pp. 1-6, 2016.
- [7] J.R. Allen, "Plant responses to rising carbon dioxide and potential interactions with air pollutants," *Journal of Environmental Quality Abstract*, Vol. 19, No. 1, 1990.
doi: 10.2134/jeq, 19, 1, 1990.
- [8] A.M.J. AlObaidy, A.J. Almashhadi, "Heavy metal contaminations in urban soil with Baghdad city, Iraq," *Journal of Environmental Protection* Vol.4, pp. 72-82, 2013.
- [9] D.T. Ahmed, "The reality of the recreational areas in Baghdad and the possibility of being illustrated by Baghdad Island as a model," *Al Mustansiriya Journal for Arabic and International Studies*, Vol. 57, pp.169-194, 2017.
- [10] A.L. Page, R.H. Miller, D.R. Keeney, "Methods of soil analysis, Part 2, Chemical and Microbiological Properties, 2nd edition," Publisher Madison, Wisconsin USA, 1982. Doi:10.9734/BJAST/2016/21520, 2015.
- [11] P.C. Nagajyoti, T. Lee, M. Sreekanth, "Heavy metals, occurrence and toxicity for plants, A Review," *Environmental Chemistry Letters*, Vol.8, No. 3, pp. 199-216, 2010.
- [12] H. Fazal, T. Aziz, "A Mini Review on Lead (Pb) Toxicity in Plants," Department of Biotechnology, University of Malakand, Pakistan, February 24, 2015.
- [12] A.M.J. AlObaidy, M.A. Alshawi, A.J. Almashhadi, "Efficiency of *E. microtheica* and *E. camaldulensis* Tree to Remove Lead Element P) from the province of Baghdad," *Engineering and Technology Journal*, Vol.34, No.3, 2016.