Sys Rev Pharm 2020;11(10):1215-1218
A multifaceted review journal in the field of pharmacy

Accumulation of Heavy Metals in Trees Grown in Urban Gardens of Nassiryah City, Iraq

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ABSTRACT

Heavy metal pollution in roadside soil and trees because of traffic emission has been recognized for a long time of *Nasiriyah city, Iraq*. The study was conducted to examine the heavy metals content of five plant species of *Zizphus, Cordia, Morus, Salix alba and Ficus* the concentration of heavy metals was tested, including the iron, zinc and copper. Heavy metals were detected using an atomic absorption spectrometer. The accumulation of Fe, Cu, and Zn in roadside soil was affected by human activity. Significant difference ($p<0.05$) in Fe, Cu and Zn content were found in soil samples. The results showed that the highest concentration of iron *in Morus* leaves and *Ficus* leaves. Among the *Zizphus, Cordia, Morus, Salix alba and Ficus* studied, showed higher heavy metals concentration Zn and Cu of *Zizphus leaves*. The results indicated that the *Salix alba* leaves had the lowest heavy metals content compared with *Zizphus, Cordia, Morus, and Ficus*. It could be concluded that impaction of traffic emission on the accumulation of heavy metals in roadside trees and soils in urban area was slight.

Keywords: Heavy Metals**,** Urban Area**,** *Zizphus, Cordia, Morus, Salix alba, Ficus*

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INTRODUCTION

Pollution is the spread of pollutants in natural environments that negatively affect the components of the ecosystem soil, water, plants and human health [1] Heavy metals can be enriched through both anthropogenic and natural action. Heavy metals are sourced from the following processes:) weathering, such as volcanic eruptions, soil parent matter, windblown dusty, and marine aerosols) agriculture, including animal waste fertilizers, sewage sludge, irrigation water, pesticides and common fertilizers [2] energy production, such as smelting, mining or power station emissions [3], secondary metal production/recycling, scrap metals, alloy plating and refining, urban industrial action, such as waste disposal and waste incineration, and automobile action, such as petroleum combustion [4]. Heavy metals tend to consider as micronutrients, as they can assist it the development and growth of plants. Examples of such beneficial metals include Fe, Mg, Cu, Zn, Ni and Mo. Alternatively, other unknown biological purposes of heavy metals, such as Pb, Al, Cd, Co, Se and Hg, are still absorbed by plants, as a result of their mobility in water and their movement within especially acidic soil environments [5]. Metals that are found within the environment can be moved via air and water, consequently being bound in soils. This consequently results in an increase in the metal concentration within different soil substrates [6]. Soil is fundamental to a range of terrestrial ecosystems; it contains a scope of organic solids and minerals. Soils can contain especially high levels of heavy metals. However, upon extraction of heavy metals, these concentrations tend to increase further. Research has found that heavy metal contamination within a range of different soil types was the result of human action, such as sewage sludge, fertilizer use, pesticide action and water irrigation [7]. Heavy metals tend to exist as cations, under normal conditions, thereby producing soil sediments and colloid complexes, which tend to be negatively charged and contain particles of clay. Forming this complex is relatively slow, which may increase the risk of these metals become bioavailable for further contamination of soils or water sources, thereby affecting human activity [8-9]. The aim of this study was to determine of heavy metal pollution in roadside soil and trees because of traffic emission has been recognized for a long time of Nasiriyah city,

MATERIALS AND METHODS

Study Area

Leaves of four different species of plants (*Zizphus, Cordia, Morus, Salix alba and Ficus*) samples were collected from roadside of Nasiriyah city**.**

Plant Samples

For plant parts, leaves were collected at the same sites where the plant samples were taken. The leaves were carefully hand-picked from the trees at young stage (free diseases). All samples were saved in box during transporting back to the laboratory at the department of Biology, University of Thi-Qar. plant samples were washed with tap water to remove soil particles twice with distilled water and deionized water. The plant leaves of *Zizphus, Cordia, Morus, Salix alba and Ficus* were cut into small pieces, and then oven dried at 60 ^{0}C for 48 h [10].

Samples Digestion

Extraction of heavy metals from soil and plants (*Zizphus, Cordia, Morus, Salix alba and Ficus* leaves) were done by wet digestion according to the [11]. Dried samples were weighed in a conical flask with HNO_3: $HClO_4$ (2:1) for 3-4 hours on a sand bath at a temperature of 100 ^{0}C until all brown fumes had changed to white. Digested samples were filtered with a 0.45 µm pore size cellulose nitrate membrane filter paper and the volume was made up to 50 ml with deionized water. Heavy metals concentrations were determined by atomic absorption spectrometer.

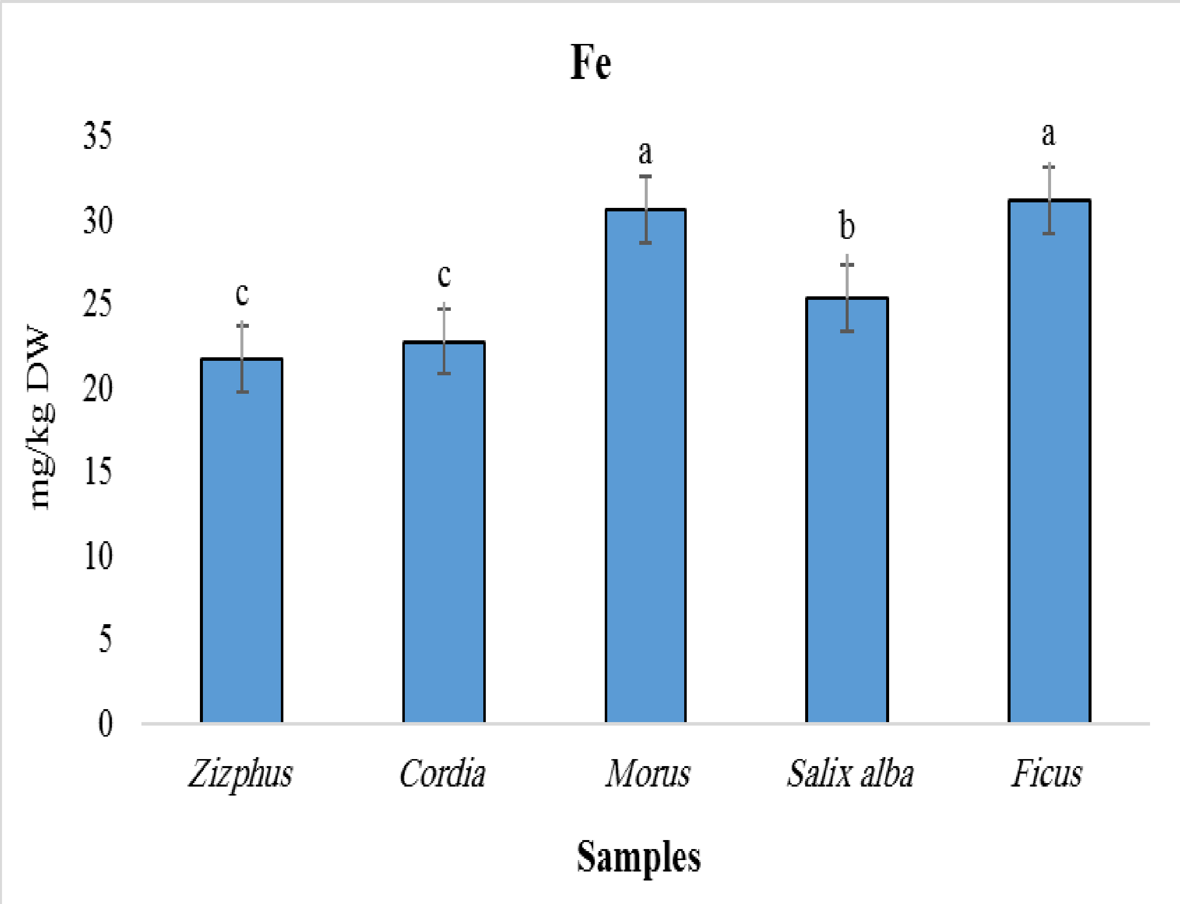
Statistical Analysis

All the analyses were conducted in triplicates. The heavy metals for the leaf's extracts were evaluated with the one-way ANOVA and Duncan triplicates range test using SPSS software (SPSS ver.23). P values less than 0.05 were considered to be statistically significant. Values were expressed in means ± SD [12].

RESULTS AND DISCUSSION

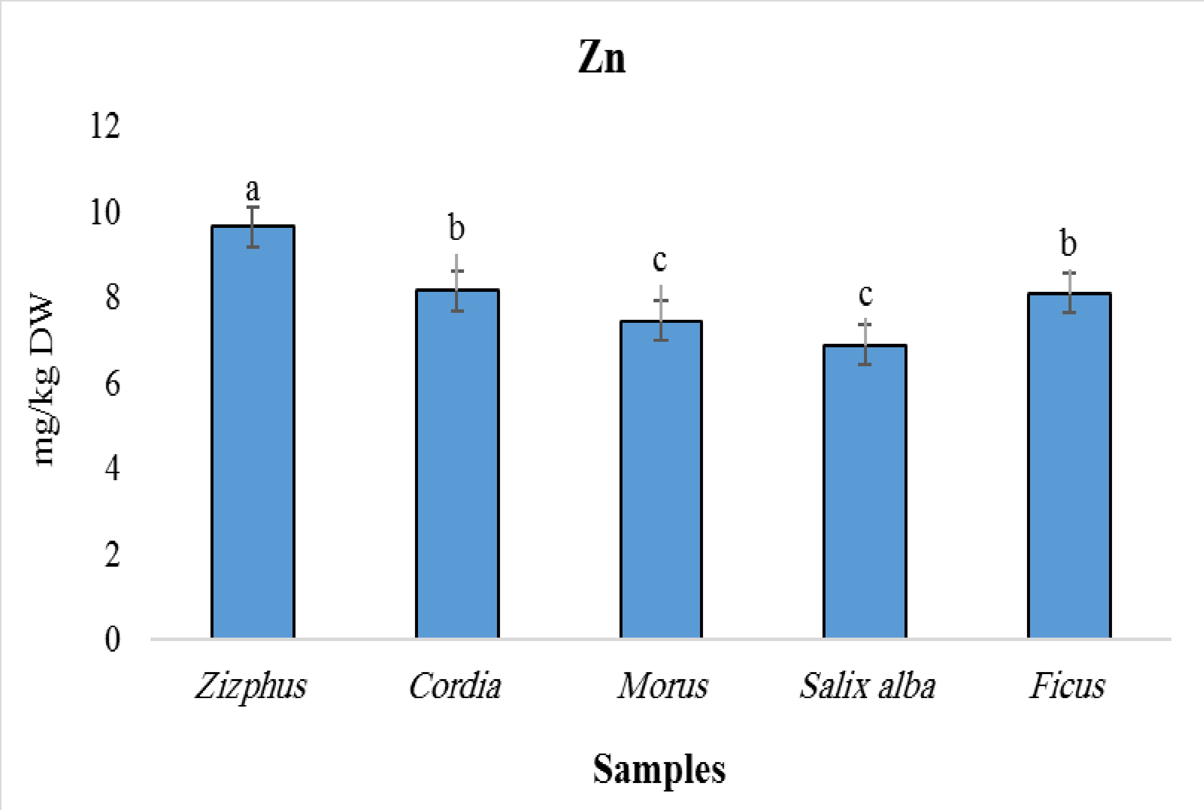
Heavy Metals Content of Tree and Soil Samples

Statistically significant differences (P<0.05) in the variance analysis for all iron measurements of tree samples were found in Fig1. The Fe contents in the tree samples were higher than other metal cations. In the investigation area, the highest mean iron content in *Ficus, Mours, salix alba, Cordia* and *Zizphus* (31.20, 30.70, 25.40, 22.80 and 21.75 mg/kg DW respectively). The result showed that the Zn accumulation in *Zizphus* leaves were more than *Ficus*, *Cordia, Mours* and *Salix alba* leaves. As seen in the variance analysis among zinc contents in Fig 3, there were significant differences (P< 0.05) in all tree's samples. Mean Zn content was the highest in the *Zizphus* leaves (9.67 mg/ kg DW). The results showed that *Cordia* leaves have significantly (p<0.05) in Zn content compared to *Eucalyptus, Mours leaves* and *Salix alba* leaves (8.17, 7.46 and 6.90 mg / kg DW respectively). These results showed that for all plant samples and growing environment had influence on Zn content. Comparing Zn content from this study and other study data is difficult because of the fact that content of Zn can be affected by technique, solvent, species and site [13-15]. reported that Zn concentration of 24 mg/kg medicinal plants samples and Zn content from 17.70 to 87.55 mg/kg. The copper content for four different species of trees (*Zizphus, Cordia, Ficus, Morus and Salix alba* leaves at urban area is presented in Fig 2. The results of variance analysis show that there were significant differences (*p*<0.01) among tree samples. The highest Cu value as a mean of the sampling was at *Zizphus* sample (1.33 mg/kg DW), while notice a significant decrease in *Cordia, Ficus, Morus and Salix alba* leaves (1.09, 1.00, 0.99 and 0.87 mg/kg DW respectively). Significant differences (p<0.05) in Cu content were found between the tree samples. Both *Zizphus* leaves and *Ficus* had higher Cu content. When comparing the data from this research with other study, results from different sources seriously differ. The Cu mean value in this research showed that leaves were higher than that of fruits [15-16]. The result showed that the Fe accumulation in soil were more than Cu and Zn (Fig 4). As seen in the variance analysis among zinc, coper and iron contents there were significant differences (p< 0.05) in heavy metals concentration in soil. Mean Zn content was the highest in the soil sample (28.30 mg/ kg DW). The results showed that soil sample had significantly (p<0.05) in Zn content compared to Cu (24.88 and 10.80 mg / kg DW respectively). Comparing Fe, Zn and Cu content from this study and other study data is difficult because of the fact that content of Fe, Zn and Cu can be affected by technique, location [13-15].

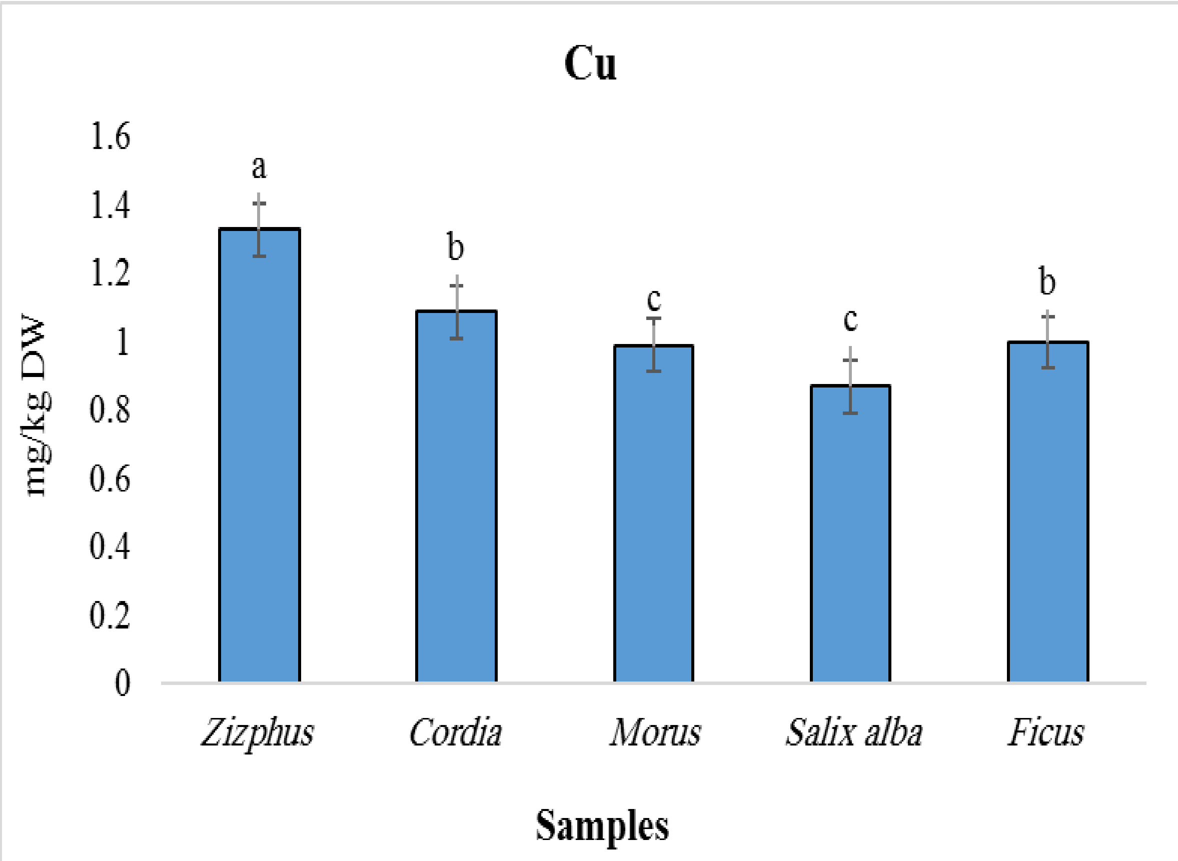


a–c Different letters indicate significant difference (P< 0.05)

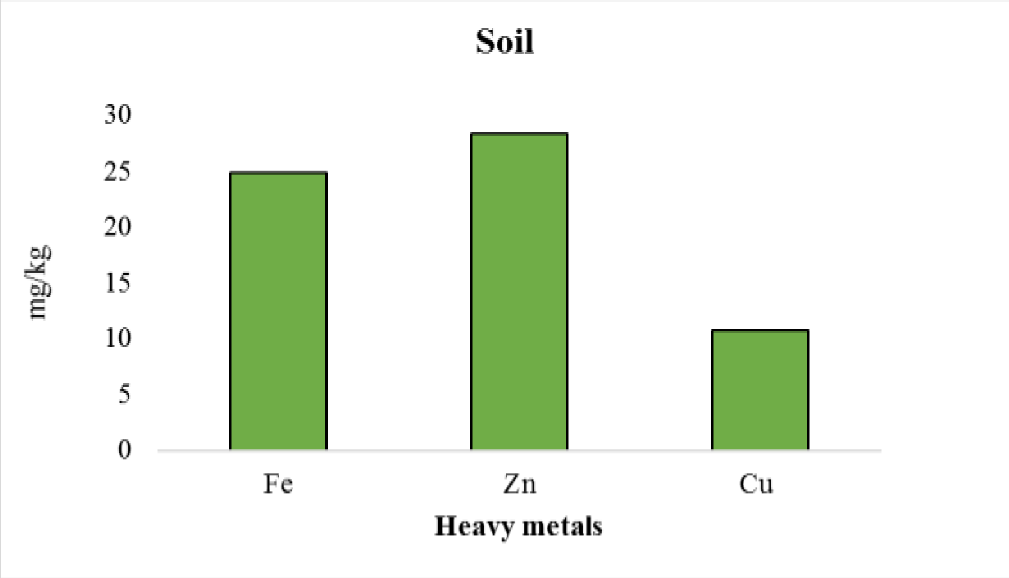
Fig 1. Iron content in trees leaves extracts, (mg /kg DW)



a–c Different letters indicate significant difference (P< 0.05)
Fig 2. Znic content in trees leaves extracts, (mg /kg DW



a–c Different letters indicate significant difference (P< 0.05)
Fig 3. Cooper content in trees leaves extracts (mg /kg DW)



a–b Different letters indicate significant difference (P< 0.05)

Fig 4. Heavy metals content in soil sample (mg /kg DW)

CONCLUSION

Content of heavy metals in urban grown trees is related to the location in the city. trees near sources of pollution such as main roads increase the accumulation of heavy elements by about twice as much as those of trees grown in urban gardens of pollution. The results indicated that for all trees and growing location had effect on heavy metals content. *Mours* and *Zizphus* gave the highest, Fe, Zn and Cu content when compared with rural area, so these trees (*Salix, Ficus* and *Cordia*) can be used to treat pollution in cities.

ACKNOWLEDGEMENT

This research was supported by University of Thi-Qar, Faculty of Education of Pure Science, Department of Biology, Iraq.

Conflict of Interest: None

Funding: self

Ethical Clearance: Not required

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