Accumulation of Heavy Metals from Herbaceous Plants

Environment and Botany

Keywords: Bioindicator, bioaccumulation, Integral, cycle, food chain, anthropogenic, Standard, indicators, Dendograme.

Gezim Bara | **Faculty of Natural Sciences. University of Tirana, Albania.**

Abstract

Aim of the article: The aim of this article is to determine the accumulation of heavy metals by plants: Plantago Major, Taraxacum officinale, Trifolium pratense and use of these plants as bio-indicator to show the level of contamination by heavy metals in Durres.

Material and methods: The methodology consisted of work sampling for research and use of macroscopic and microscopic methods for determining the choice of herbs and metals using some criters.Herbs were collected in five different points of the city (rural and urban) used as control points for contamination with heavy metals.

Results: were analyzed based on the measurement of physico-chemical parameters in various locations coast Durres.Results analysis showed that the accumulation of heavy metals defined depends on the type of plant being studied and varies according rradhes.P. Major> T.Pratense> T.Officinale.From analysis results revealed a good correlation between the concentration of heavy metals in soil accompanying the root of herbs and plants themselves which indicates that plants accumulate metals linearly throughout the time of flowering thereof.

Conclusions: Based on the results and achievements of our research and other data we can conclude that heavy metals have a cumulative effect and can have toxic consequences for human health and therefore, we believe that this paper will bring the impact of innovation on heavy metals pollution in the area of the environment.

Introduction

Long time ago, plants are used as bio-indicator, as bioaccumulation to determine the level of atmospheric contaminants including heavy metals in the environment. (Manning and Feder, 1980; Kovács 1992)

Identification of the presence of metals and their level in different environments is defined by the characteristics of plants, by their bioaccumulation and length of their presence in the environment (life cycle of the plant) (Posthumus, 1988; Chappelka et al 2004).

Determination of the level of heavy metals in the environment using plants as bio-indicator is accepted as an effective method to recognize the impact of metals in biological systems. Plants represent an integral response to pollutants.

Heavy metals are natural elements that are present at different levels in different countries. Heavy metals are sustainable elements and they are found in the environment in different natural concentrations.

The problem with the heavy metals in the environment comes when their mobility is greater and when their concentration increases due to human activity.

This paper presents the level of accumulation of heavy metals by plants in the city of Durres.

Selection of Plants

For the selection of plants to be used as bioaccumulation for heavy metals there are used several features:

- Plants should have different organs: roots, stalk, and leaves in order to see the level of metals, in each of these organs, their bioaccumulation characteristic.
- Plants should have a much wider spreading, so that they can be found in more environments.
- Plants must have a long life cycle so that their accumulation times to be longer.
- Selected plants that meet these conditions are: Plantago Major, Taraxacum officinale.

Selection of Metals

Heavy metals that are selected will be determined based on the criteria below:

- They are metals defined as toxic, not only for plants but also for the above mentioned food chain.
- Modify or inhibit plant growth.
- Come to the environment from different natural or anthropogenic sources.
- Metals to be determined are: Cu, Zn, Ni, Mn, and Pb.

Defining the Sampling Stations

Sampling points are defined based on the following criteria:

- Selected places with increased human activity (industrial areas, near roads with vehicular movements) in order to determine the impact of human activity on environmental pollution with heavy metals.

- Selected places with low human activity (rural areas) and possibly areas where there is no human activity, forests or mountains.

Sampling stations

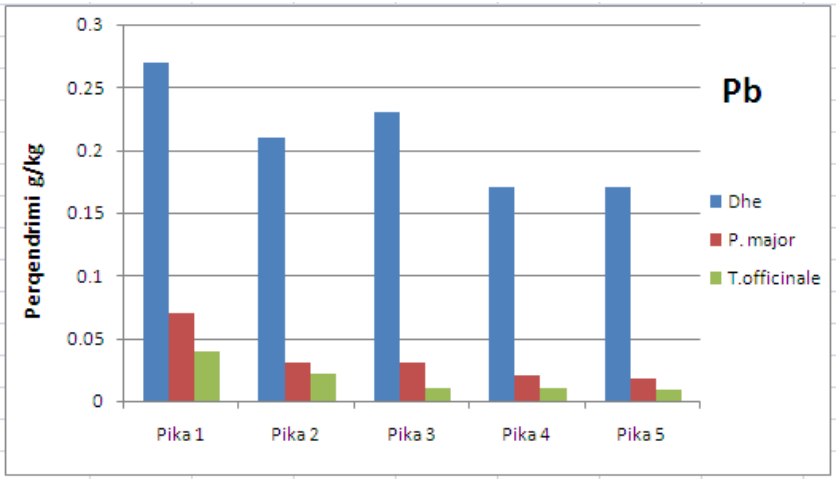
Station 1 Hornbeam Trees (near the site of collection from merging bacteria)
Station 2 Entering the city of Durres
Station 3 See-port (to the ferries)
Station 4 Promenade of the city of Durres
Station 5 Ishem (in the forest).

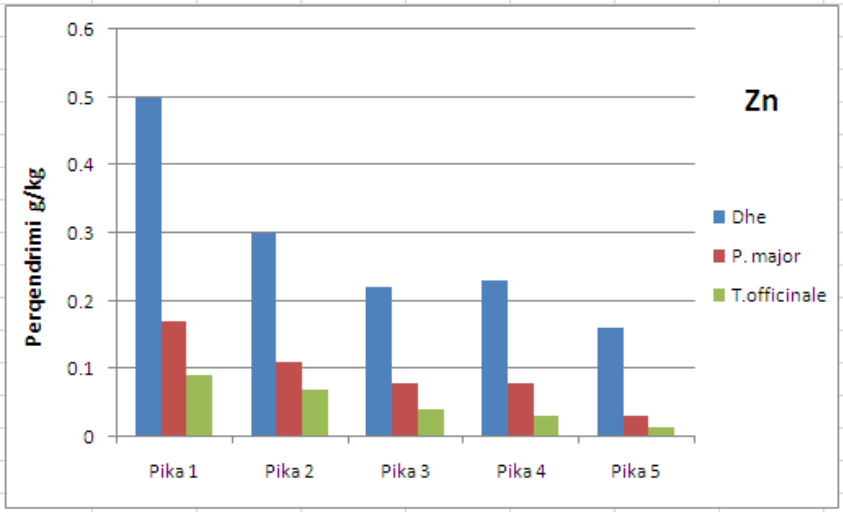
Results and Discussions

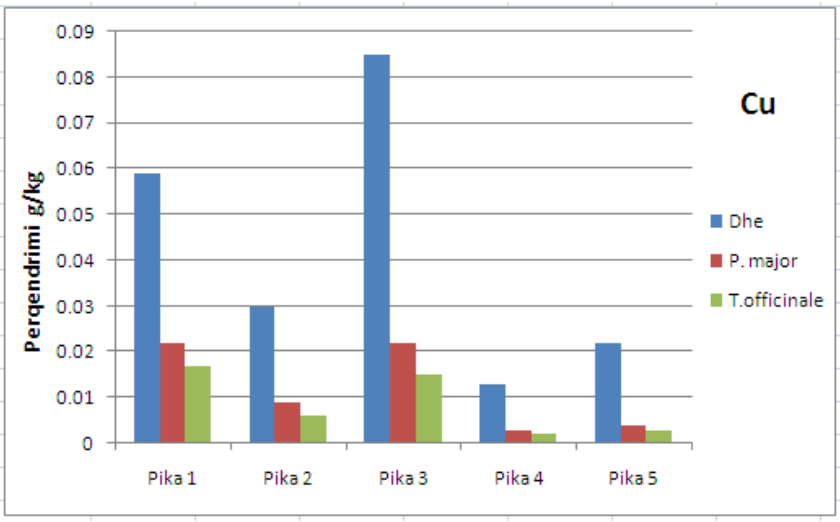
In the table below are presented the average values and standard deviations expressed in g/kg of metals determined and accompanied in plants as well as in their leaves *P.major* and *T.officinalis*.

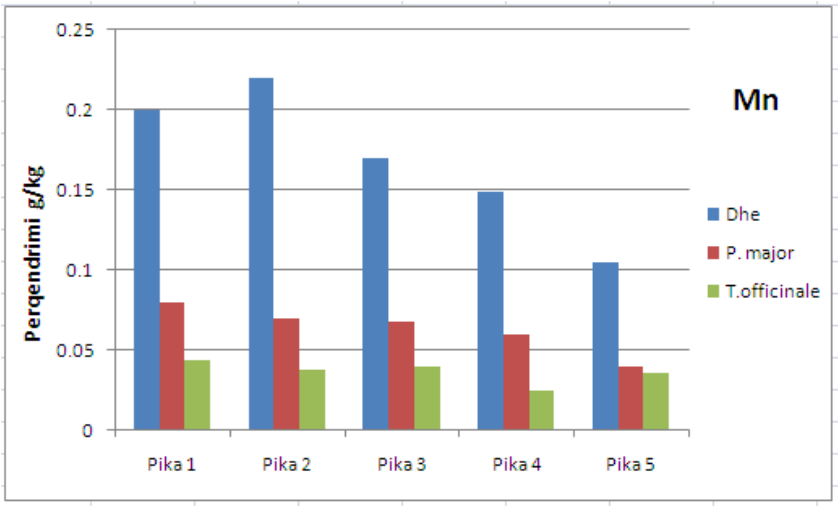
	Pb	Cu	Zn	Mn	Ni
Soil	0.22 ± 0.05	0.42 ± 0.04	0.286 ± 0.15	0.168 ± 0.046	0.192 ± 0.097
P. major	0.039 ± 0.022	0.013 ± 0.01	0.095 ± 0.06	0.066 ± 0.02	0.062 ± 0.024
T. officinalis	0.018 ± 0.009	0.0085 ± 0.007	0.05 ± 0.03	0.036 ± 0.007	0.024 ± 0.009

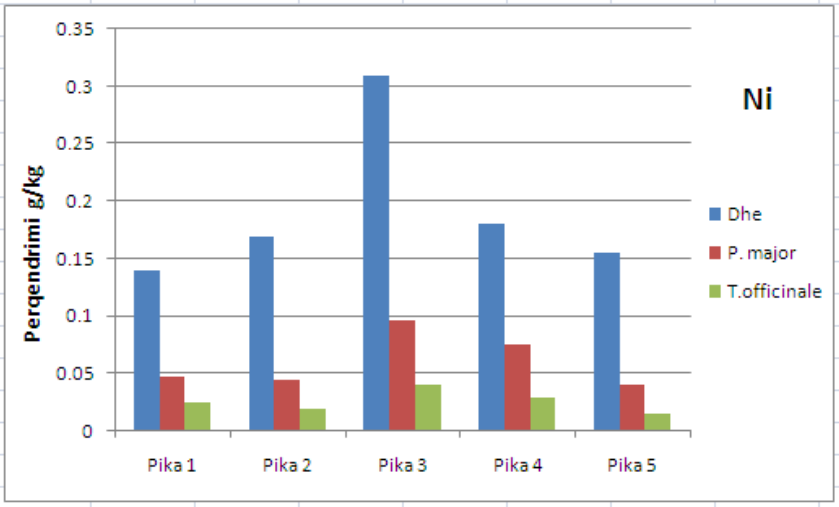
In the figures below are presented average values of metal concentrations determined in soil and plants indicator.



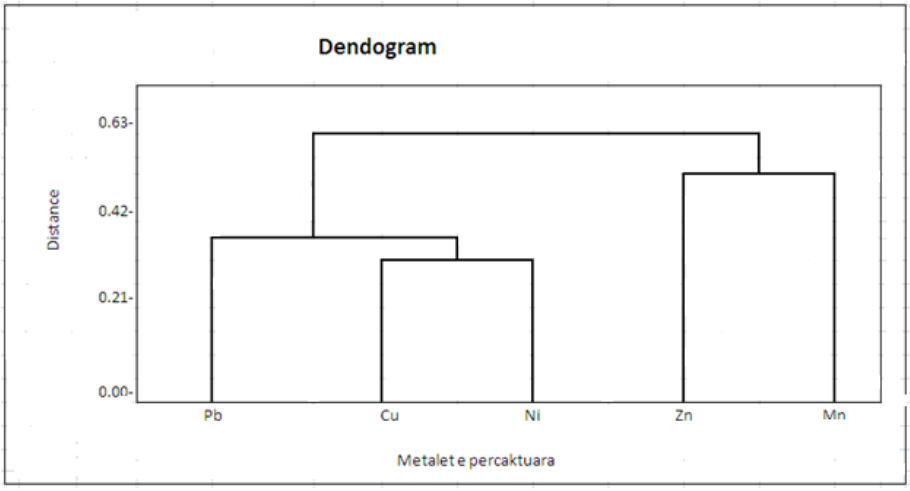




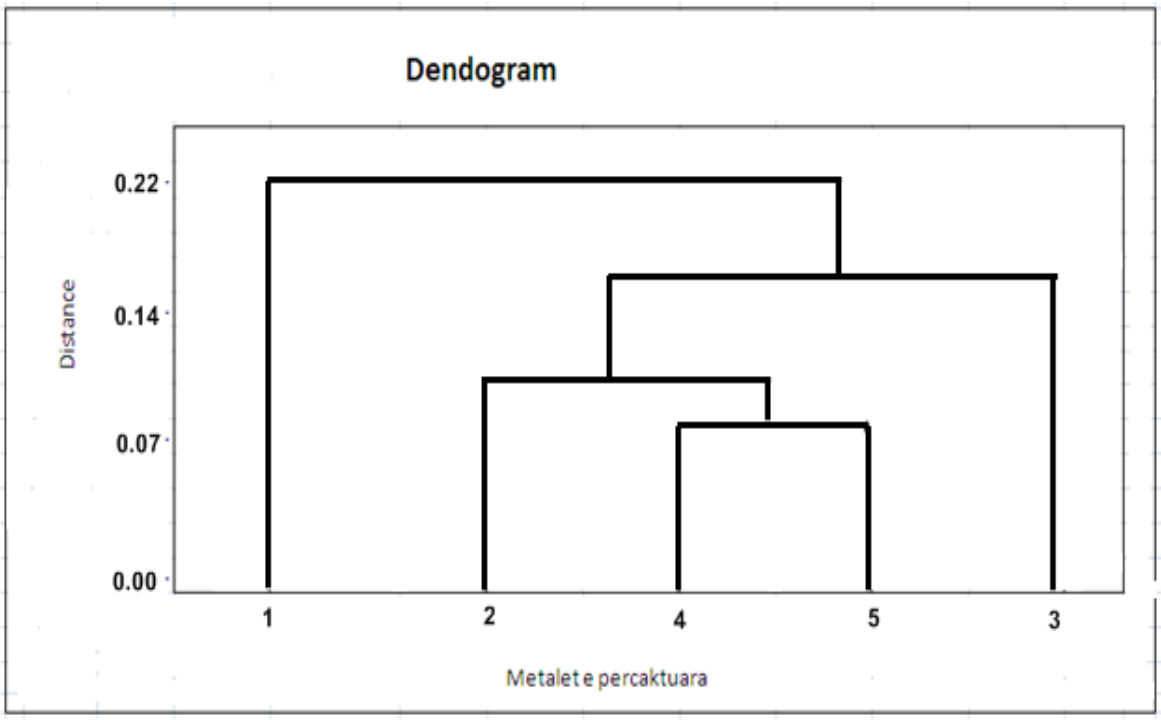




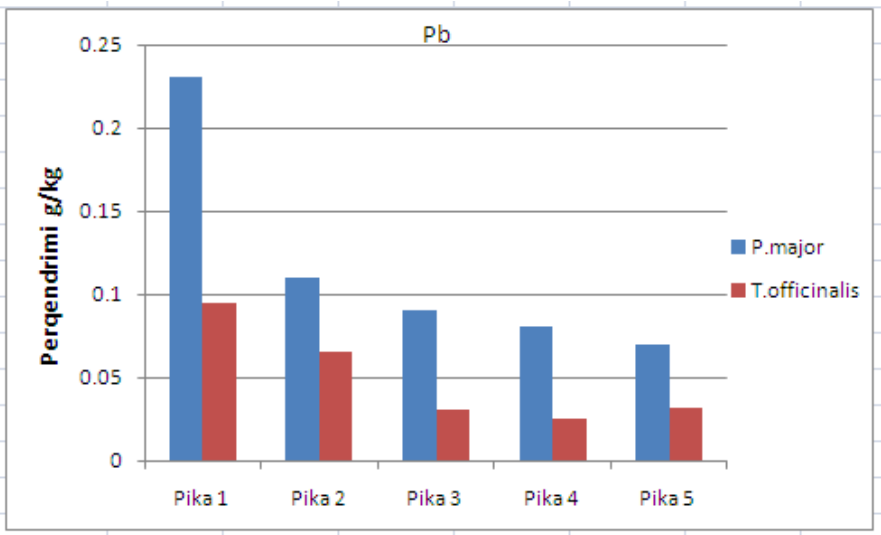
In the figure it is shown the Dendrogram which represents the relationship among defined metals. Among determined metals it can be noticed that Cu with Ni have closer concentrations to one - another.

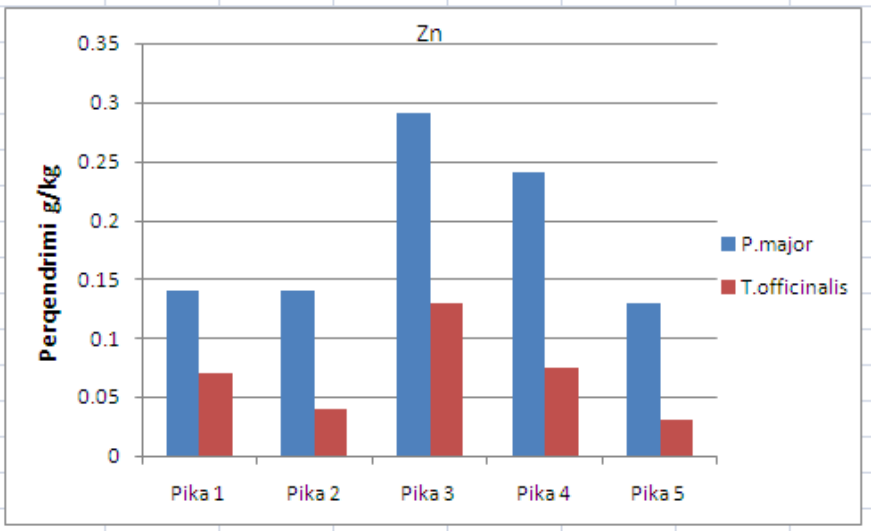


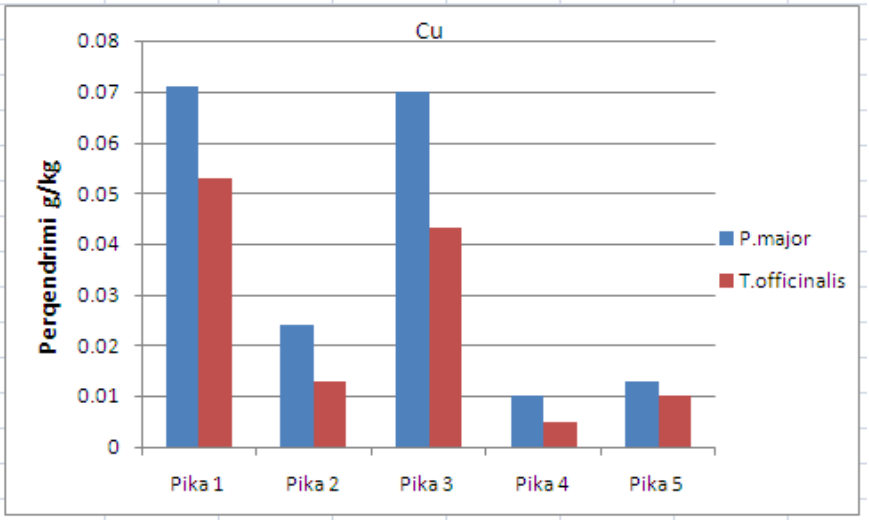
The figure shows the relationship between Dendrogram and the sampling stations. By the Dendrogram can be noticed that items 4 and 5 are items that have greater similarity in the concentration of metals. Station 1 represents the highest pollution.

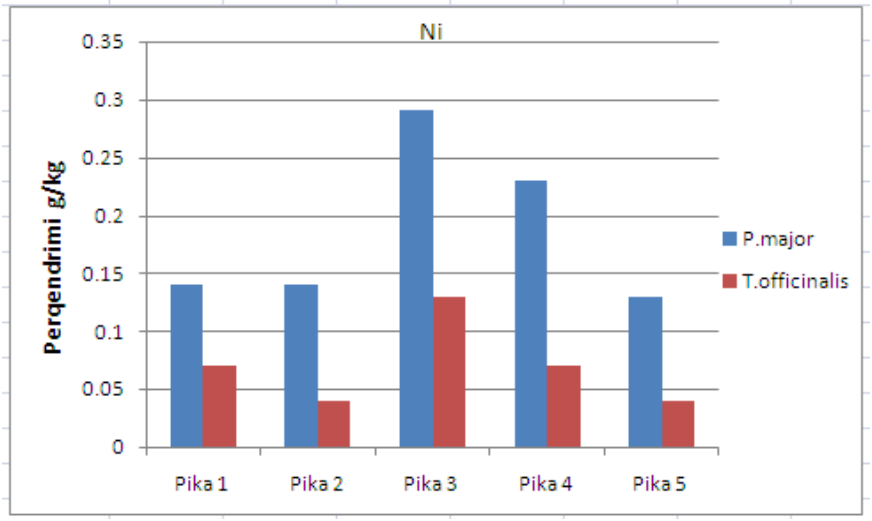


In the figure, it is shown the concentration of metals determined by the sampling stations. The figure shows that the highest concentration in all determined metals represents Zn and Pb.




Zn
Perqendrimi g/kg
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Pika 1
Pika 2
Pika 3
Pika 4
Pika 5
P.major
T.officinalis


Cu
Perqendrimi g/kg
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Pika 1
Pika 2
Pika 3
Pika 4
Pika 5
P.major
T.officinalis


Ni
Perqendrimi g/kg
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Pika 1
Pika 2
Pika 3
Pika 4
Pika 5
P.major
T.officinalis

Conclusions

From the results of the analysis can be concluded the following:

- Metals determined in this work are present in the determined environments.
- Ranking of determined metals by their concentration in soil in *P.major* and *T.officinale* is given in order
- Zn>Pb>Ni>Mn>Cu.
- The accumulation of metals was higher in *T.officinale* compared with *P.major*.

For each metal, the higher concentration was in *P.major* and smaller in *T.officionale*. Among determined metals Cu with Ni have closer concentrations with each another. Among the sampling stations, station 1 had the highest concentration of metals while lower concentrations had stations 4 and 5.

References

1. Manning W.J., Feder W.A. (1980). Biomonitoring Air Pollutants with Plants. Applied Science Publ., London. England, UK.
2. Kovács M. (1992): Trees as biological indicators. – In: Kovács M. (Ed.), Biological indicators in environmental protection. – Ellis Horwood, New York.
3. Posthumus A.C. (1988): Monitoring of the State and Influence of Air Pollution. - In: T RESHOW, M. (Ed.), Air Pollution and Plant Life, - Hydrometeoizdat, Leningrad, 98-125 pp. (in Russian).
4. Chappelka, A.H., et al Effects of ozone on the nutritive quality of select plant species. Abstracts, 36th Air Pollution Workshop, April 26-29, Rhinelander, WI.