



AENSI Journals

## Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: <http://www.aensiweb.com/AEB/>

## The study of lead level of absorption in plants *Euonymus Japonicus Microphylla*, *Hedera Canariensis*, *Rosmarinus Officinalis* in Laleh Park area in Tehran City

Mahdi Nasiri and Ali Abedini

Young Researchers and Elite Club, Borujerd Branch, Islamic Azad University, Borujerd, Iran

### ARTICLE INFO

**Article history:**

Received 26 September 2014

Received in revised form 20 November 2014

Accepted 25 December 2014

Available online 2 January 2015

**Keywords:**

Lead, the level of lead absorption, contamination, lead risks *Rosmarinus Officinalis*, *Euonymus Japonicus Microphylla*, *Hedera Canariensis*.

### ABSTRACT

The amount of "lead", released into the atmosphere annually, is over 300,000 tons, which its most important sources refer to human activities such as burning of gasoline and coal. Lead is one of the heavy metals and the pollution of environment by this element is of high importance, because it can enter the body through digestion or respiration and then affects many glands of the body, causing many serious diseases in humans and other organisms. The aim of this research is the assessment of lead uptake by three plants namely: *Rosmarinus Officinalis*, *Hedera Canariensis*, *Euonymus Japonicus Microphylla*. A comparison of the level of absorption and the amount of lead existing in the air of that area, and to what extent it can be higher the allowable level? **Method:** Three plants namely *Euonymus Japonicus Microphylla*, *Hedera Canariensis* on July, 2013 and *Rosmarinus Officinalis* on February, 2014 were taken as samples from Laleh Park area in Tehran. For preparing to determine the level of absorption they were stored to be dried for 10 days away from direct sunlight, then sent to research center of Azad University, Khorasgan Branch, in order to be studied. For determining the level of absorption we used Atomic Absorption Technique and ISIRI 12968 standard method and ISIRI 3903 testing method in mg/kg unit. **Conclusion:** According to the collected information, the amount of absorbed lead in *Euonymus Japonicus Microphylla*, *Hedera Canariensis* and *Rosmarinus Officinalis* was nearly the same and about three times higher than allowable level, also the level of absorption by *Rosmarinus Officinalis* was about 70 times higher than allowable limit. In accordance with the information obtained from this article, three results can be inferred. Firstly, lead level in environment of that area exceeds the permitted level. Secondly, some residents of these areas used these contaminated plants in their cooking recipe, and thirdly *Rosmarinus Officinalis* comparing to two other plants has more ability of "lead" absorption. So we come to this conclusion that, by growing more of this plant *Rosmarinus Officinalis* we can absorb more lead from air.

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**To Cite This Article:** Mahdi Nasiri and Ali Abedini., The study of lead level of absorption in plants *Euonymus Japonicus Microphylla*, *Hedera Canariensis*, *Rosmarinus Officinalis* in Laleh Park area in Tehran City. *Adv. Environ. Biol.*, 8(25), 206-210, 2014

### INTRODUCTION

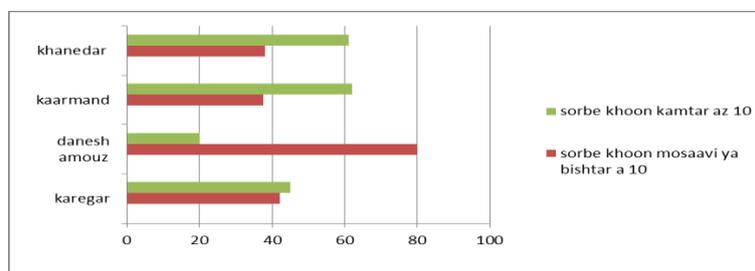
Socrates identified abdominal pain as a symptom of lead poisoning in 370 BC. In 1700 AD, Ramazzini noticed potters who worked with lead suffer specific diseases. In 1993 Kehoe and coworkers identified high amount of lead in the environment [5]. Studies showed that, although lead is not an essential metal for human body but there is a measurable amount of it in the tissues and some body fluids of adults. Nowadays, there are a lot of articles regarding negative effects of lead. Lead poisoning signs range from clear symptoms to hidden ones. This element exists naturally in stones with different densities through chemical weathering and erosion of minerals they can enter the soil, air and water, and consequently they go to plants and humans food chain (5). Lead can enter the body of living things by variety of ways, affecting different parts of the body. Lead affects some biochemical and physiological actions of the body [1]. Because lead is widely used in industrial applications and different products, it is considered as one of the major occupational and environmental hazards. Industrialization of human societies caused many problems and hazards for residents living near industries or near busy streets and roads. One of the most important outcomes is absorption of lead through skin, which affects different body organs as kidneys, heart, bone marrow, digestive system and etc... The most important

**Corresponding Author:** Mahdi Nasiri, Young Researchers and Elite Club, Borujerd Branch, Islamic Azad University, Borujerd, Iran

sources of lead in the environment are printing houses, paint producer factories, different refineries, car exhausts, etc ... [2]. In addition to adults, children are also at risk of serious lead poisoning, which has consequences like reduced IQ, reduced short term memory, disability in reading, impairment in speech, and motor skills, negative effects on the time of reflexes of hands and eyes. The connection between the level of lead in blood stream and negative effects on IQ, reported more than 30-40 mg/dl [7]. The level of lead can be a good option for studying the lead level and its potential risks. In a research which has been done in Arak city, which is less industrialized comparing to the city we took the sample from, indicates that lead poisoning is seen in different age categories, and most of infections is in children and teenagers [2]. According to table 1 and figure 1 most of those whose blood lead level is more than microgram per deciliter are in range of 10 to 20 years old (57.1%). Matching these information with Pearson test results indicates that there is a meaningful relationship between age and the level of lead in the blood ( $P < 0.01$ ) [2].

**Table 1:** The relationship between blood lead level and gender in Arak city. (The numbers in parentheses represent the percentage).

The relationship between blood lead level and gender in Arak city							
Blood lead level ( microgram per deciliter )							
Gender	0 -9	0-19	20 -29	30-39	40-49	50-59	60 -69
Man	325	99	47	36	24	19	8
	(49/0)	(46/1)	(57/3)	(51/4)	(44/4)	(65/5)	(27/3)
Woman	338	116	35	34	30	10	3
	(51/0)	(53/9)	(42/7)	(48/6)	(55/6)	(34/5)	(72/7)



**Fig. 1:** Compared with people with different jobs between the two groups with normal and abnormal blood lead levels in residents of the city, years 2001-2002 ( $\mu\text{g} / \text{dl}$ ).

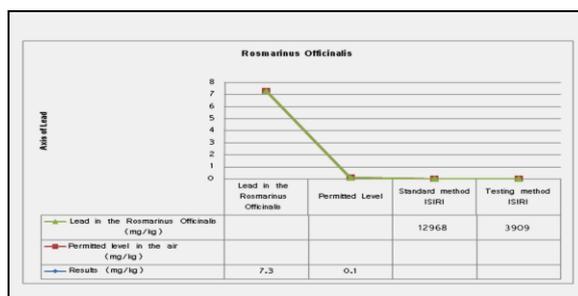
In fact, about 20 to 40 percent of lead is absorbed into the body through air. Mutually when the lead level in air is high, the lead level in the blood would also be higher [5]. It is worth noting that the amount of absorbed lead through digestive system via food and water is more than respiration of lead but the absorption through respiration system is much easier [5]. Given that, lead gets into the food chain mainly by plants (5). in the article we start the research from plants, and selected the most industrialized city of Iran as a place for taking samples. The selected area from which the test samples were taken named "Laleh Park", which is one of the most busy and crowded streets of the city, but in case of car traffic it is in the middle category. Since in this area there is no factory which emits lead, the pollution mostly comes from car exhausts. There are many families that use *Rosmarinus Officinalis* in their recipes and baking foods, so by doing this wrong action the lead gets into the foods and then into the body.

#### Main body:

The average density of lead in those plants growing in natural soils, ranges between 26 to 85 microgram in the ash, but those plants growing in lead contaminated soils are much more polluted hundreds times more. In this research three decorative plants were selected for three reasons: Firstly, they are among the most common plants in green places all over Iran, so they can be a good criterion in this case. Secondly, some of plant families like *Rosmarinus Officinalis* which is highly contaminated with lead may be in foods, and thirdly they are easily available and picking them is quite easy. For measuring the absorbed lead, we used the leaves of these plants, because the leaves having more exposed surfaces are good options for testing and measuring the lead level. For better understanding of sampled location and its distance to lead emission source (street), some images have been prepared. Based on these Figure 5 is about 6 meters, *Euonymus Japonicus Microphylla* cm and 50 about *Hedera Canariensis* 3 meters away from street. It is noteworthy, that, according to Figure 2 and more distance of *Rosmarinus Officinalis* comparing to other plants, it absorbed more lead. After preparing the leaves and doing the test, as it is clear in table and diagram, the amount of absorbed lead by *Rosmarinus Officinalis* is 7.3 mg/kg but the allowable limit is 0.1, ( $< 0.1$ ). so it can be said this amount is 73 times higher than allowable limit (Figure 3).

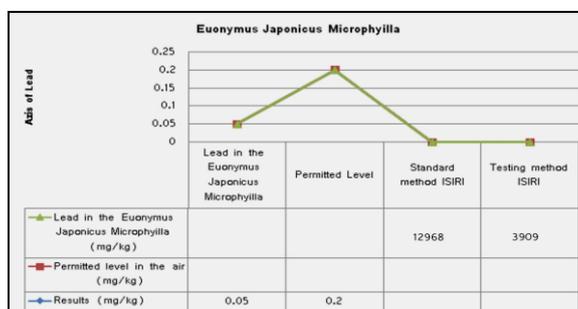


**Fig. 2:** A: location of *Euonymus Japonicus Microphylla*. B: location of *Hedera Canariensis*. C: location of *Rosmarinus Officinalis*. D: A general view of sample area 1) location of *Euonymus Japonicus Microphylla*. 2) location of *Hedera Canariensis*. 3) location of *Rosmarinus Officinalis*.

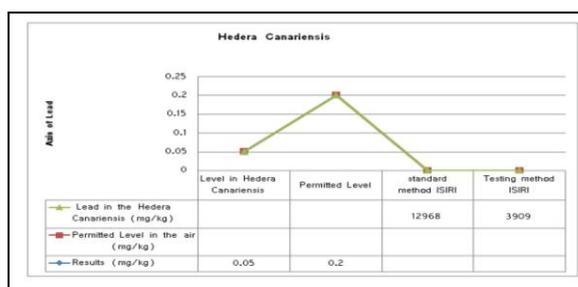


**Fig. 3:** *Rosmarinus Officinalis* Studying the level of lead absorption in the plant In this diagram you can see that absorption of lead in the air by the plant, is much more than permitted level.

After measuring the lead level in *Euonymus Japonicus Microphylla* with regard to its table and diagram, the level of lead was 0.05 mg/kg but the allowable limit is 0.2 ( $< 0.2$ ) (Figure 4).

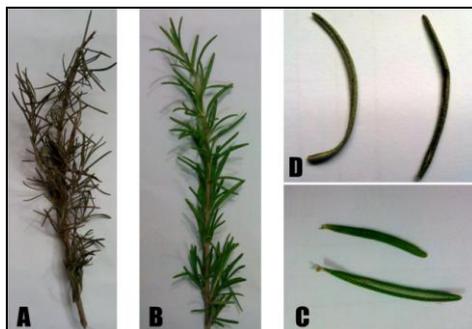


**Fig. 4:** *Euonymus Japonicus Microphylla* Studying the level of lead absorption in the plant In this diagram it is visible that absorption of lead in the air by the plant, is lower than permitted level and measuring the level of lead in *Hedera Canariensis* according to the related table and diagram was 0.05 mg/kg but the allowable limit is 0.2 ( $< 0.2$ ). (Figure 5).



**Fig. 5:** *Hedera Canariensis*, Studying the level of lead absorption in plant, In this diagram it is visible that absorption of arsenic in the air by the plant is lower than permitted level.

What is noteworthy here is that while studying samples of these three plants, it was clear that the level of contamination in leaves of *Rosmarinus Officinalis* was higher than two other plants, this condition could be seen by naked eye, because the color of leaves was darker and close to black, comparing these samples with those of less contaminated areas, for example Borujerd city, which is nearly 400 kilometers away from Tehran, showed that the level of contamination is lower in plants taken from less crowded areas. Although the level of contamination was higher in *Rosmarinus Officinalis* grown in Tehran city and it was because of physiological damages, but it had more fragrance comparing to other city's *Rosmarinus Officinalis* grow in Borujerd city. The above mentioned tips including weakening of plant organs are shown in images A, B, C and D (Figure 6).



**Fig. 6:** A morphologic comparison between *Rosmarinus Officinalis* of Borujerd city and Tehran city. Images A and D: *Rosmarinus Officinalis* of Tehran City. Images B and C: *Rosmarinus Officinalis* of Boruejrd City.

#### Method:

Two plants of *Euonymus Japonicus Microphylla*, *Hedera Canariensis* in July 2014 and *Rosmarinus Officinalis* in February, 2014 were taken from Lale Park area in Tehran city, the leaves of these plants were dried away from direct sunlight, then sent to Isfahan Azad University Research Center Khorasgan Branch, to study and determine their lead level, in this measurement Atomic Absorption Technique, and ISIRI 12968 standard test method and ISIR 3909 in mg/kg unit were used.

#### Conclusion:

"Lead" is not necessary element for growing the plants, but it is absorbed by the plant and the plant is exposed to contamination by this poisonous element. In such a condition in addition to damages to plant, humans and other animals which eat these plants are exposed to lead poisoning [5]. One of these three plants, used in this study is *Rosmarinus Officinalis*, which is used in foods by some families. Taking advantage of all information obtained in this research, we come to this conclusion: Firstly *Rosmarinus Officinalis*, comparing to two other plants, is more successful in absorption of lead, despite of the fact that it had a greater distance from the street and picked up sooner than two other plant samples. Of course, for getting more reliable results, we should test other plants too. Secondly, the level of lead, existing the air of area was higher than allowable level and this could be dangerous for humans and animals health, causing many diseases. Thirdly, people many use these plants in their foods so this contamination can be transmitted to human body through these plants because these plants have potentiality to absorb lead, and this may have many harmful effects on human body and other animals. And finally, with more studies and performing other researches continuously, we may be able to lower the contamination in crowded and industrial areas with lot of traffic, by planting more *Rosmarinus Officinalis*. In this case we would be able to absorb more lead from the environment and lower the level of lead contamination in nature.

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