Research Article

Study of Heavy Metal Accumulation in Plants in the Town of Peja

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ABSTRACT

Pollution is a very problematic area of life, after the industrial revolution. Now we are dealing with a phenomenon, which has a detrimental effect, earth, water, air and food from them passes, jeopardizing public health. Deposited substances in the environment can be inorganic and organic nature, for example, heavy metals, fuels, hazardous waste, oil and other fuels etc. Heavy metals (Pb, Cu, Zn, Cd, Ni), are without degradable outdoor, therefore air pollution from heavy metals present as a global problem. Natural sources of pollutants are volcanoes, forest fires, biological decomposition processes and oceans. Sources associated with anthropogenic emissions from various industrial activities and vehicular traffic. The main sources of urban pollution are heating systems, combustion of solid waste, emissions from heavy traffic and especially industrial processes.

Keywords: metals, plants, health, environment.

INTRODUCTION

Environment is the totality of the circumstances surrounding an organism or group of organisms, especially the combination of external physical conditions and natural, affecting growth, development and survival of organisms. The environment is everything that surrounds us: earth, water, air and living organisms. The balance between human activities and natural consequence is broken and constantly changing environment[1].

Figure 1: Municipality of Peja site-sampling analysis (Picea Abies, Taxus baccata).

The Purpose of the Study

Air quality can be monitored by measuring the concentrations of pollutants in the air or directly deposited in different species. For this purpose a growing interest has been the use of bio organisms like mosses, lichens, or leaves of higher plants[11]. Part of the higher plants are vascular plants. Vascular plants make the accumulation of heavy metals through atmospheric deposits on the leaves, or by absorption from the ground because they are equipped with root system, the system of seedlings and the vascular system, which together circulating water, food and minerals from the roots to the leaves, enabling the absorption of various pollutants from the soil as well as from the air.

Heavy Metals

The term "heavy Metal" (MR) refers to any metallic chemical element that has a relatively high density 5 g.cm~ appeared³ and toxic properties at low concentrations.

Metals in our body come in small concentrations through food, drinking water and air.

Duration of pollution can be hundreds of thousands of years, p.sh: the first half lives are: Cd: 15-1100 years, Cu: 310-1500 years and Pb:740-5900 years depending on soil type and parameters physico-chemical[12].

Among heavy metals, trace elements that behave like can be mentioned zinc, copper, selenium, which are essential to maintain metabolism in the human body. Their accumulation in high concentrations can lead to poisoning of the body.

Heavy metal poisoning can result from contamination of drinking water (p.sh from lead pipes and asbestos), but can come from air pollution as a result of high concentrations of these metals near sources of emission or since their introduction into the food chain[13].

Emission of metals into the atmosphere from natural sources worldwide (thousands of tons per year) is estimated as: Ni: 26, Pb, 19, Cu 19, As, 7.8, Zn 4, Cd: 1.0, Se: 0.4 (x103 tons/year), while anthropogenic sources given as 450 Pb, Zn: 320, Ni 47, Cu 56, as 24, Cd: 7.5: 1.1

(x103 tones / year). As seen from the data, Pb, Zn, Ni and Cu are the main pollutants from human activities.

Heavy Metals in Plants

In the case of terrestrial ecosystems mostly radical absorption performed by plants, which draw their food from the ground.

Transport of heavy metals into the biological mechanisms occur under the following points:

- Movement earth elements from the roots of the plant;
- Membrane elements pass through the epidermal root cells;
- Transport elements of epidermal cells in the xylem, where also a solution of the elements is transported from roots to shoots[3].

Some species have skill accumulation, such that are able to tolerate high concentrations of one or more heavy metals in the air. Engage in collecting high volumes of metal in their aerial parts (heavy metal concentrations in the aerial parts of the plant dry weight are: Cd> 10 0 ľg g~¹, Cr, Ni, Pb, Cu> 1000 ľg g~¹, Mn, Zn> 10,000 ľg g~¹).

Air Quality

The main source of air pollution in urban environments. In automotive transport Kosovo R. circulating over 450,000 vehicles per day. About 80% of the diesel fuel and only 20% gasoline. In addition the majority of vehicles are depreciated (about ½ are staples of 80's and only 4.5% were manufactured after 2001)[9].

This has meant that emissions of polluting gases and dust in the air to be much higher, creating premises for the formation of smog situation and increasing cases of cancer diseases.

Heavy Metal Pollution due to Road Traffic

Lead is a metal that is released during fuel combustion processes; Zn, is derived from tires and copper powder is derived from corrosion of the radiator and brake; Other heavy metals are mixed backgrounds. Origin of Zn which comes from road traffic is also corrosion ABS braking system. Heavy metals more important, related to traffic today are: Cu, Pb and Zn[9].

Metals other important emitted by traffic, respectively, Cd, Cr, Cu, Ni, Pb, Sb and Zn amortization brake, Zn, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni and Pb, by tire abrasion and Cd, Cr, Cu, Ni, Pb, and V, component of gases released by burning fossil fuels.

Heavy Metals in the Environment and Food Security

According to a definition given in the course of the World Food Summit held in Rome in 1996, "Food Safety exists when all people, at all times, have food safe and nutritious enough to meet the needs and preferences their food in order to have a healthy and active life "(FAO, 2006). Even if the earth and the air are not the only factors to be taken into consideration are fundamental areas when it comes to food safety, but always remains the biggest challenge she Feeding a growing world population[8].

Besides food processing processes, from raw materials inorganic pollutants can enter the factory mainly along the substrate absorption process to reach concentrations toxic to plants, animals and human beings themselves[3]. In addition it is to consider the fact that many cases, trace elements, can create problems for food safety even when they are below the permissible amount. Once their lack of food chain causes high risk for human beings.

The Effects of Heavy Metals in the Environment

Heavy metals, which are under consideration in this study are: Cu, Pb, Zn, Mn, Fe, Na, K, Mg, Ca and Hg. They either essential or non-essential have a special significance in ecotoxicology high thanks to their ability and the toxic effect that living organisms exhibit. Why metals may exhibit toxic properties, it is that they can replace the essential metals in the pigments or enzymes, damaging their function: food, water, air and penetration through the skin[10].

Heavy metal toxicity can affect mental impairments or disorders, central nervous functions, damage to the blood composition, lungs, liver and other vital organs.

Based Biomonitoring of Higher Plants Conifer Trees

Coniferous trees are more sensitive indicator of air pollution than deciduous trees, because they are exposed to air pollution for a longer period of time (3-4 years), except Larix deciduas, which honors needles her every year.

Figure 2: The plant which is taken for analysis (Picea Abies).

So most of the coniferous trees can accumulate a large amount of pollutants, even at very low concentrations. Taxus baccata, Picea abies, Pinus silvestris and Pseudotsuga menziesi are often indicators used in monitoring air pollution[9].

The use of higher plants, especially the leaves of trees, air monitoring is becoming more widespread.

Many plants can absorb and accumulate various metals from their environment. Plant tissue analysis to identify the type and level of accumulated metal is very useful in studying the problem of metal pollution in the air. (Picea Abies).

The term "hiperakumulator" describes a number of plants that share the ability absorption of heavy metals in plants[5].

Plants (Picea Abies) are very helpful in identifying more air pollution from heavy metals.

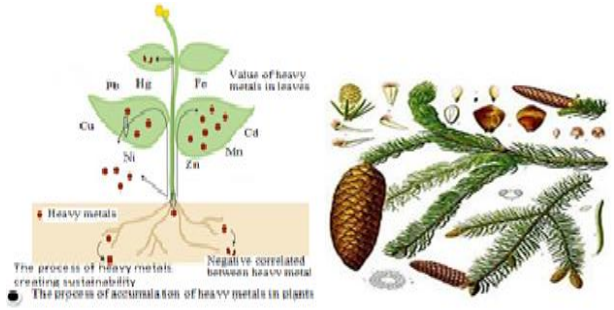

Figure 3: The scheme of circulation of toxic substances in the plant (Picea Abies).

MATERIALS AND METHODS

Samples were taken at various stations throughout the area of Peja near the roadway. Monitoring stations are almost uniformly distributed. Sampling is done in almost all the main streets and at key points. Fig: 1.

After transporting the samples of leaves of plants in the laboratory, first became drying samples. Then they were placed on the sheet of paper to dry at ambient conditions of the laboratory environment, staying just 3 weeks. After drying the leaves became their homogenization[6].

Figure 4: View from the drying process of fragmentation of coniferous leaf samples.

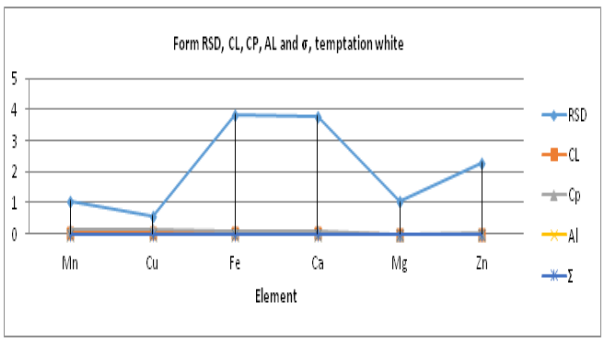

Figure 5: Graphical presentation RSD, CL, CP, AL and σ, for white test.

The relative standard deviation (RSD), provides information about various statistical errors or inaccuracies different in the analysis as well as in the preparation of standard liquids. Standard deviation (σ), identifies the exactness of the analytical method used[7]. The limit of detection (CL), called the amount of analyze that gives smaller signal, which is detected with reasonable certainty for a given analytical procedure. Absorbance limit (AL), is the analytical signal below which the measure cannot, in cases where the value of the signal is less than 0.0044 shows that have deviations from the law of Beery, this value is usually taken 0.0044. Concentration determining (CP), which shows the concentration to guarantee optimal statistical parameters.

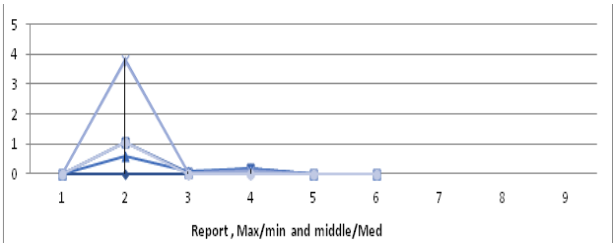

Figure 6: Graphical presentation Among the report / ratio Median and Max / Min.

The ratio of maximum to the minimum value for Mn, is greater than 300 by expressing the impact of anthropogenic outdoor pollution, while regarding us, this report is worth over 40 at the same time expressing his nature anthropogenic and natural.

Chemical Analysis

The contents of Cu, Zn, Mn, Fe, Ca, Mg, were determined by atomic absorption spectrometry (SAA) using air-acetylene flame, while the determination of Na and K was determined by atomic emission spectrometry (AES) with flame. Determination of Pb and Cd metal was performed using atomic absorption spectrophotometers with electrothermic Atomizer with graphite furnace. As for determining the content of Hg absorption techniques used cold vapor (CV-AAS)[8].

Table 1: Pollutants in some areas of Peja, compared to the EU legal norms (μgm-^{3}), in 20016.

No. the site-sampling	PM10	SO_2	NO_2	O_3	Pb
Peja Hospital	116	14	35	88	0.2
Center	110	13	34	90	0.14
Brewery	57	12	28	99	0.11
Economic School	132	29	47	83	0.2
KFOR barracks	89	14	20	98	0.2
Raushiç	99	13	29	77	0.1
Vitomiric	87	12	30	80	0.2
EU norms	50	50	40	121	0.5

Table 2: Emissions of some air pollutants of Peja in 2016

Values pollutants polluting / 2016	CO	NOx	PM10	Benzene	Toluene	Ethyl	PM2.5	O_3	SOx
Peja	0.343	12.8	50.1	1.3	3.20	0.51	28.02	16.44	1.88
EC norms	5	40	50	0.5	X	1	25	110	50

Table 3: Presentation of RSD, CL, CP, AL and σ, for white test.

Element	RSD	C_L	Cp	Al	Σ
Mn	1.04	0.045	0.135	0.0043	0.0007
Cu	0.54	0.053	0.166	0.0046	0.0008
Fe	3.89	0.049	0.112	0.0059	0.0015
Ca	3.89	0.029	0.070	0.0048	0.0005
Mg	1.06	0.005	0.002	0.0049	0.0014
Zn	2.60	0.009	0.025	0.0045	0.0005

Table 4: Comparison between samples and parallel (A - A‘).

Sample	Cu	Pb	Cd	Zn	Mn	Fe	Na	K	Mg	Ca	Hg	Bima
A1	13.0	3.19	0.1	28.0	170	458	95	1702	5323	6455	0.49	Taxus baccata
A1’	14.0	2.89	0.09	30.6	185	390	79	1554	5847	8701	0.39	Taxus baccata
B4	14.7	2.69	0.08	40.4	87	365	28	1450	4978	6283	0.39	Taxus baccata
B4’	13.5	3.99	0.09	32.7	89	363	29	1650	5100	6669	0.30	Taxus baccata
C15	7.4	6.02	<0.02	21.9	55	593	149	1788	3383	3850	0.50	Picea abies
C15’	8.6	6.12	<0.02	25.0	37	494	160	1670	3429	4579	0.52	Picea abies
E40	9.4	3.01	<0.02	30.6	38	497	238	1598	1781	2820	0.45	Picea abies
E40’	8.2	3.74	<0.02	26.9	31	474	255	1557	1691	3072	0.57	Picea abies

Table 5: Results of statistical data processing (EXCEL, Descriptive Statistic).

No	Hg	Pb	Cu	Zn	Fe	Mn	Na	Mg	Ca	K
Middle	0.37	3.72	12.3	33.5	559	206	334	3929	5385	385.8
Med	0.39	3.51	9.94	38.7	471	89	107.9	3839	5424	170.4
Min	0.12	1.46	3.81	18.1	183	11	5.98	1841	2505	68.5
Max	0.98	14.6	23.1	181	1469	3471	5736	6722	8917	310.4

Table 6: Among the report’s presentation / report Median and Max / Min.

Element	Hg	Pb	Cu	Zn	Fe	Mn	Na	Mg	Ca	K
Report Middle / Med	0.119	1.20	1.10	2.69	1.18	3.11	2.22	1.00	1.31	1.05
Report Max/Min	0.667	7.71	12.73	331	7.10	938	45.86	3.02	3.97	8.29

Table 7: Rezultatet “Descriptive Statistic” for all heavy metals in plant samples.

Nr	Middle	Med	St Dev	Variance	Coef.Var.	Max	Min	Skewnesa	Kurtosis
Cu	9.99	8.78	3.27	10.9	33.3	15.9	3.69	0.38	-0.18
Pb	3.66	2.66	2.69	8	73.6	13.9	1.35	2.65	6.55
Cd	0.02	0.02	0.02	0.001	69.2	0.07	0.02	1.255	-0.22
Zn	29.0	20.9	11.8	126	35.1	48.9	15.1	0.61	-0.93
Mn	71.2	55.2	354	1224	48.6	157	32.4	0.88	0.13
Fe	444	394	190	37900	45	1055	288	2.37	6.45
Na	189	167	115	12551	62.2	5193	1841	-0.51	0.31
K	1661	1670	156	22460	8.85	1990	1493	0.25	-1.09
Mg	3657	3665	891	804311	27	5088	1756	-0.53	0.37
Ca	4800	5000	1523	2488222	32.9	8573	2505	0.32	0.82
Hg	0.035	0.037	0.13	0.015	0.288	0.055	0.017	-0.25	-0.36

Peja area of plant (Taxus baccata) are deposited on the maximum levels of these elements: Pb, Cd, Zn and Ca. The sources of these elements are of anthropogenic character (from heavy traffic, debris and exposed environmental household heating system). School Zone economic results in high levels of Mg deposition as a result of adding green areas, being an essential element for coniferous plants. In plant (Picea Abies) note that the element of K has a low variation (CV <25%) showing a high consistency of analytical data.

While all other elements are relatively stable showing a difference between data (25% <CV> 75%), which exhibit a moderate behavior influenced by various factors.

CONCUSION

Peja city are among the areas with large urban pollution in the country. The most significant air pollution are major roads and paths.

In the town of Peja note that the tendency of distribution of elements sorted order is: Hg>Pb>Cu>Zn> Mn>Fe>Mg>Ca>Na>K. Here we can see more clearly the changes in the concentration of various elements of the monitoring points.

While elements such as Cu, Pb, Zn, Fe, Mg, Ca and Hg are relatively stable, showing moderate behavior, which is influenced by various factors anthropogenic and natural. The swing has been the level of concentration of the element mercury (Hg), which has a major impact on the presence of burning waste from irresponsible people.

Recommendations

Protection of human health, the environment and air quality achieved through an efficient legal control regarding emissions of pollutants from various anthropogenic sources, in accordance with standards or discharges into the environment. Achieving a high efficiency legislation on environmental pollution is achieved through constant monitoring of European professional standards.

Improve the air quality standards in the cities of our country are:

Reduce the number of cars by promoting the use of private versus public transport, improvement of public transport; management of road network; strict control of the marketing of fuels in order to reduce the level of concentration of Pb and Hg deposited into the environment as a result of vehicle fuels or during the heat of housing; promotion of cleaner vehicle technologies; of green growth; improving the quality of fuels.

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