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Assessment of Lead Concentration in the Aerosol Sampling Using Different Analytical Techniques

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Abstract. The instrumental methods of analysis with destructive and non-destructive used to determine metals concentration in aerosol samples. The purpose of this study is to determine the lead concentration in aerosol samples using different analytical techniques. We have selected 8 aerosols samples, which are divided in two parts and only one in four parts. We have analyzed a total 18 filter aerosol samples. Aerosol samples are collected in Tirana and Elbasan cities and were analyzed for lead content by using Graphite Furnace Atomic Absorption Spectrometry, Flame Atomic Absorption Spectrometry and X-ray Fluorescence in the Institute of Applied Nuclear Physics, University of Tirana, Albania. From the results obtained show that the level of lead in the aerosol samples that are collected in Elbasan is higher than in samples are collected in Tirana. By the use of various techniques in the measurement of lead in aerosols it is noticed that the more information is obtained from the technique of X-ray while for the presence of lead in low concentrations, GFAAS technique has the highest accuracy and sensitivity

Keywords: lead concnetration, aerosols, instrumental methods.

1 Introduction

Air pollution represents one of the main problems of environmental pollution, especially in urban and industrial areas. Both natural and anthropogenic sources contribute to air pollution. The development of technology and production of primary products also, produces secondary production, solid, liquid and gaseous waste, whose presence is associated with significant environmental impacts (M. Alushllari et al. 2014). Quality of air is very important to ecosystems and human health. Atmospheric pollutants are responsible for both acute and chronic effects on human health (WHO, 2000). Trace metals, are the most common components in atmospheric particulate material. Different studies have shown that low concentrations of metals in particulate material significantly influence on environment and human health. These health effects are more noticeable in the elderly and children (US EPA, 2006). Clean air is a basic health requirement for every human being. However, air pollution across the globe is constantly threatening human health. Presence of heavy metals in environment above maximum concentration level causes toxic effects in environment and on human's health. They enter the human body through food, water, and air. Lead

and its compounds are toxic; they can enter the human body through food, water, and air (Alushllari and Civici 2014). Also, the presence of lead causes anemia and damage of nervous system (Bastawyet al. 2006). Cadmium is an extremely toxic metal, is commonly found in industrial areas, especially where ore is processing and smelting. Exposure to cadmium can cause a number of harmful health effects due to the ability to induce disturbances in several organs and tissues following either acute or chronic exposure (Marisela, 2006). Chromium is a steely gray and non-oxidation hard metal that is in basic state malleable and lustrous (Costa and Klein, 2006). The purpose of this study is to determine the lead concentration in aerosol samples using different analytical techniques.

2 Material and Method

Samples were collected in four stations in the cities of Tirana and Elbasan. There were selected 2 points in Tirana (the terrace of the building of the Ministry of Environment and Mount Dajti building near the former Pioneer Camp) and 2 points in Elbasan (the building of the Public Health Center near the former Metallurgical Combine). Represented aerosol samples analyzed using Atomic Absorption Spectrometer, Analyst 800 Perkin Elmer with Graphite furnace Atomic Absorption Spectrometry (3 analytic methods). Air filter samples are digested according Analytic Method Atomic Absorption Spectrometry. Instrumental conditions for lead are based on the Analytical Methods of Atomic Absorption Spectrometry, from Perkin Elmer. During this study are collected in total 23 aerosol samples and 8 blank filters. For digestion of samples were used three different analytic methods. Lead concentration in samples is measured using three instrumental analytic techniques, Flame Atomic Absorption Spectrometry, Graphite Furnace Atomic Absorption Spectrometry and Fluorescence of X-ray.
Instrumental conditions for lead are based on the Analytical Methods of Atomic Absorption Spectrometry, from Perkin Elmer. Three applications were carried out for the measurement of calibration standards and the measurement of samples. For each element calibration curve equation is linear and passing through point zero. To check the instrumental drift, an aqueous standard solution was analyzed after every three samples.

3 Results

We have selected 8 aerosols samples, which are divided in two parts and only one in four parts. We have analyzed a total 18 filter aerosol samples. Aerosol samples are collected in Tirana and Elbasan cities and were analyzed for lead content by using Graphite Furnace Atomic Absorption Spectrometry, Flame Atomic Absorption Spectrometry and X-ray Fluorescence in the Institute of Applied Nuclear Physics, University of Tirana, Albania.

From results obtained show that the level of lead in aerosol samples was in range: 1.8 µg/L-2705 µg/L. Lead concentration for each method is compared between each other, relative standard deviation was 4.3 %.

In Table 1are presented the sampling points , code and amount of aerosol that has passed in paper filter. In table 2 are presented the lead concentration for the analyzed samples according 3 techniques analyses.

Table 1. Sampling points, Tirana and Elbasan Cities.

Nr of Filter	**Stations**	**Vol (m3)**	**Code of Samples**
118	Elbasan, Metalurgji	49.7	1M
111	Elbasan, Metalurgji	75.2	2M
107	Elbasan, Metalurgji	4.6	3M
110	Elbasan, Metalurgji	56.3	4M
95	Elbasan, Qendër	68	8M
105	Elbasan, Metalurgji	22.7	9M
109	Elbasan, Metalurgji	31.9	10M
85	Tiranë, Qendër	79.5	11M
53	Tiranë, Qendër	56.6	12M
52	Tiranë, Qendër	57.3	13M
80	Tiranë, Qendër	85	15M
69	Tiranë, Qendër	96.3	17M
51	Mali i Dajtit	142.7	14M

Table 2. Sampling points, Tirana and Elbasan Cities.

Nr of Filter	Code of Samples	GF_AAS	F_AAS	XRF
51	M14	2.1	0.0	1
80	M15	4.0	0.0	1
52	M13	6.0	5.6	1
69	M17	6.3	0.0	42
53	M12	8.8	5.7	1
85	M11	10.4	8.2	69
95	M8	20.7	11.7	1
110	M4	147.1	161.5	120
105	M9	472.5	379.5	371
109	M10	610.6	465.5	640
111	M2	680.4	552.0	635
118	M1	932.0	804.0	994
107	M3	2705.3	3054.0	2811

3.1 Figures

There are selected 4 stations to collected aersols samples. In figure 1 is presented map of Albania where are selected 2 cities Tirana and Elbasan

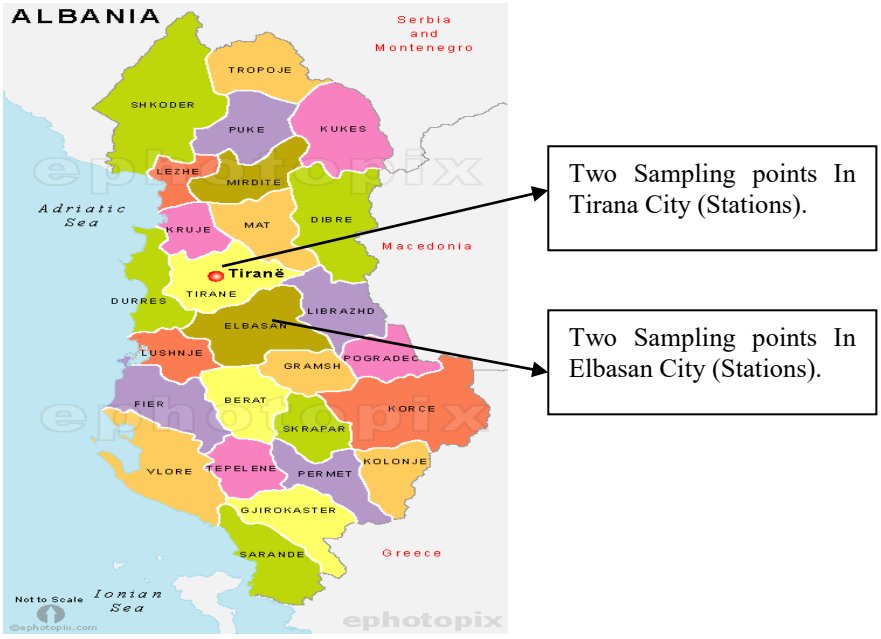


Figure 2: Sampling points ,Tirana and Elbasan Cities

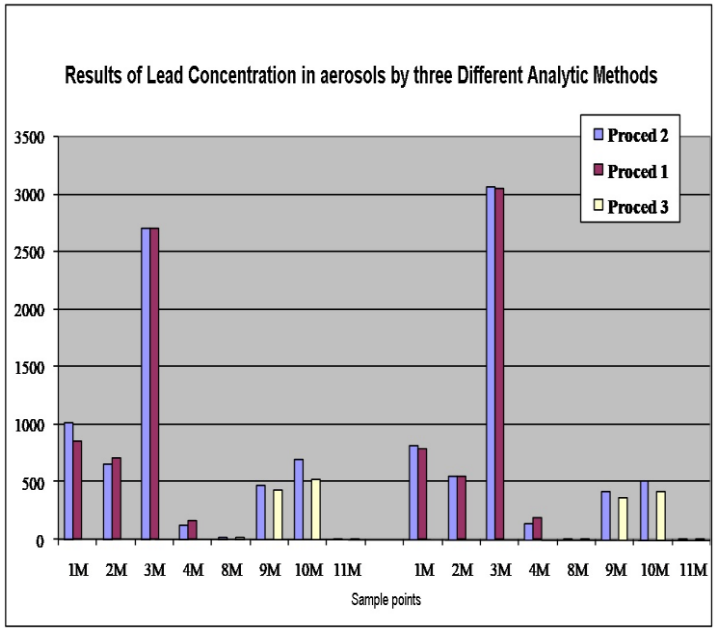
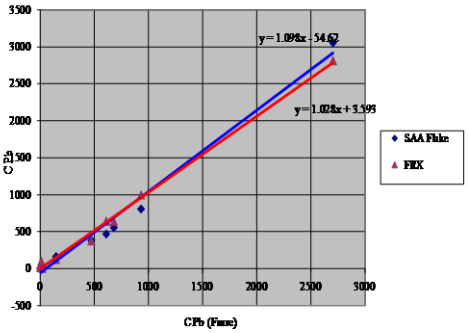


Figure 2: Comparing of Lead concentration in samples by different techniques

Figure 2: Grafical form of lead concentration by three different methods



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4 Conclusions

From the results obtained show that the level of lead in the aerosol samples that are collected in Elbasan is higher than in samples are collected in Tirana. By the use of various techniques in the measurement of lead in aerosols it is noticed that the more information is obtained from the technique of Xray while for the presence of lead in low concentrations, GFAAS technique has the highest accuracy and sensitivity.

Lead concentrations in aerosols samples which are collected in the city of Elbasan were higher than in Tirana, while the most contaminated area was near metallurgical areas. In the descending order of content in aerosols, elements analyzed in selected sampling stations, were ranked: Elbasan metallurgical>Elbasan Center> Tirana Center > Mount of Dajt.

As the main sources of air pollution by metals in Elbasan and Tirana cities were emissions from fuel burning, burning of urban wastes, dust particles transported by wind, construction and inert materials.

In the city of Elbasan, partial work in Metallurgical Combinate significantly contributes to the emission of gases in the air and solid waste in the land. In the descending order of sensitivity of techniques to measure lead concentration were

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