O 35. ASSESSMENT OF LEAD CONCENTRATION IN THE AEROSOL SAMPLING USING DIFFERENT ANALYTICAL TECHNIQUES

Mirela Alushllari[1], Sukru Dursun[2], Silvana Mico[3], Nikolla Civici[1]

[1]*Institute of Applied Nuclear Physics, University of Tirana, Tirana, Albania*
[2] *Selcuk University, Engineering Faculty, Konya, Turkey.*
[3]*Faculty of Natural Sciences, University of Tirana, Tirana, Albania*

E-mail: m.alushllari@gmail.com

ABSTRACT: Object of this study were the aerosol samples collected in Tirana and Elbasan cities. The population of our country is concentrated in the capital city of Tirana. It has a continuous development of industrial commercial and construction activity. Elbasan was chosen not only for the high population, but also and for the activity of the former Metallurgical Combine. Instrumental methods of analysis with destructive and non- destructive used to determine metals concentration in aerosol samples. The aim 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 analysed a total 18 filter aerosol samples. Aerosol samples are collected in Tirana and Elbasan cities and were analysed 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, aerosols, analytical techniques.

1. INTRODUCTION

Pollutants in air can exist in the form of gases or aerosol particles depending on temperature, humidity and other parameters. There are several hundred specific pollutant compounds that are found in the air from a mixture of different sources. As main sources of pollution in the atmosphere, may be considered: urban areas, industrial plants, automotive roads, energy plants.

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 (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 & Civici 2014). Also, the presence of lead causes anemia and damage of nervous system (Bastawyet *et 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 grey and non-oxidation hard metal that is in basic state malleable and lustrous (Costa & 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 as follows: Station 1: on the terrace of the building of the Ministry of Environment at a height of about 15 m from the road. At this station sampled aerosols were representative of the centre of Tirana. Station 2: It was set on Mount Dajti building near the former Pioneer Camp. Pumps at this station were placed at about 3 m above the ground level. These aerosol samples were representative of a clean area. Also there were selected 2 points in Elbasan as follows: Station 3: on the building of the Public Health Centre, samples were collected at 15 m height from ground level. Station4: near the station Metallurgical Combine, most of samples were collected near the Metallurgical Combinate in height about 4 m from ground level.

Other samples were collected at the entrance and inside area of the Complex. In Table 1 the date for the analysed samples is presented. Represented aerosol samples analysed 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 analysed after every three samples.

3. RESULTS

During this study are analysed in total 23 aerosol samples and 8 blank filters. We have selected 8 aerosols samples, which are divided in two parts and only one in four parts. For digestion of samples were used three different analytic methods. Lead concentration in aerosol samples is measured using three instrumental analytic techniques, Flame Atomic Absorption Spectrometry, Graphite Furnace Atomic Absorption Spectrometry and Fluorescence of X-ray at the Institute of Applied Nuclear Physics, University of Tirana, Albania.

From the results obtained is shown that the concentration of lead in aerosols samples are ranged from 2.1 ng/m^3 to 2705 ng/m^3. Lead concentration for each method is compared between each other; relative standard deviation was 4.3 %. The values of lead in Tirana are ranged: 2.1 -10.4 ng/m^3. The values of lead in Elbasan are ranged: 20.7-2705 ng/m^3.

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.

In the table 1 are presented the sampling points, code and amount of aerosol that has passed in paper filter. In the 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 (m^3)	Code of Samples
118	Elbasan, Metallurgy	49.7	1M
111	Elbasan, Metallurgy	75.2	2M
107	Elbasan, Metallurgy	4.6	3M
110	Elbasan, Metallurgy	56.3	4M
95	Elbasan, Centre	68	8M

105	Elbasan, Metallurgy	22.7	9M
109	Elbasan, Metallurgy	31.9	10M
85	Tirana, Centre	79.5	11M
53	Tirana, Centre	56.6	12M
52	Tirana, Centre	57.3	13M
80	Tirana, Centre	85	15M
69	Tirana, Centre	96.3	17M
51	Dajti Mountain	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

In figure 1 is presented map of Albania where are selected 2 cities Tirana and Elbasan. In figure 2 and 3 are presented in graphical form the level of lead respectively in Tirana and Elbasan cities. In figure 4 is presented compare of lead concentration in Tirana and Elbasan. In figure 5 is presented Compare of Lead level using three techniques, while in figure 6 is presented the Line plot of lead according three techniques and in figure 7 is presented Concentration of lead by different techniques.

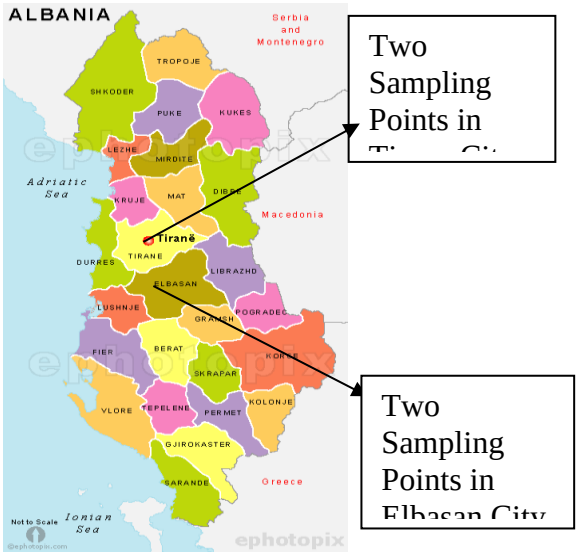

Figure 1. Sampling points, Tirana and Elbasan Cities

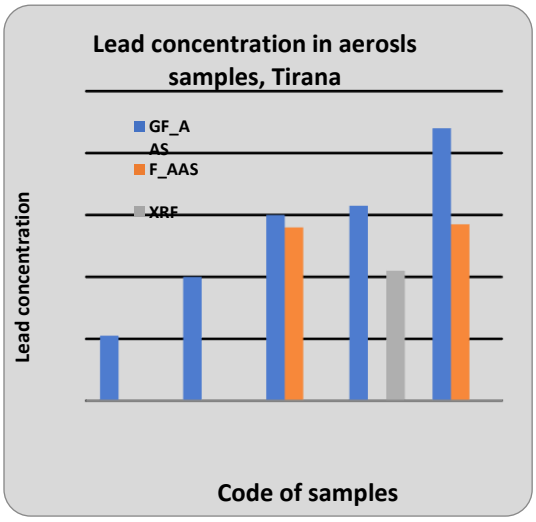

Figure 2. Lead concentration in Tirana City

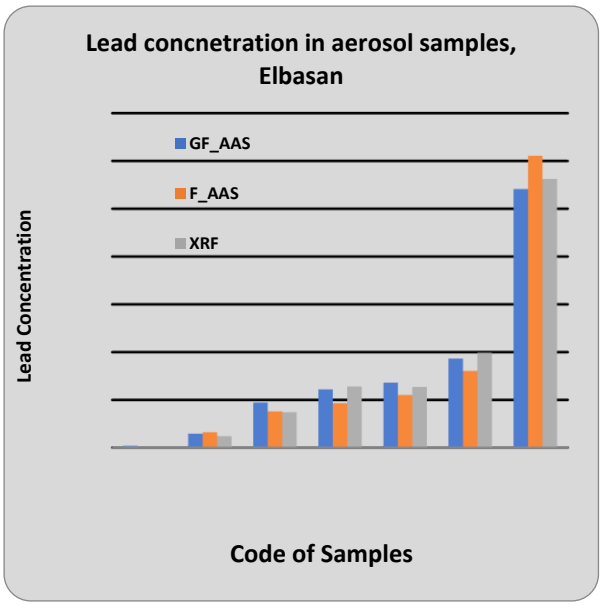

Figure 3. Lead concentration in Elbasan City City

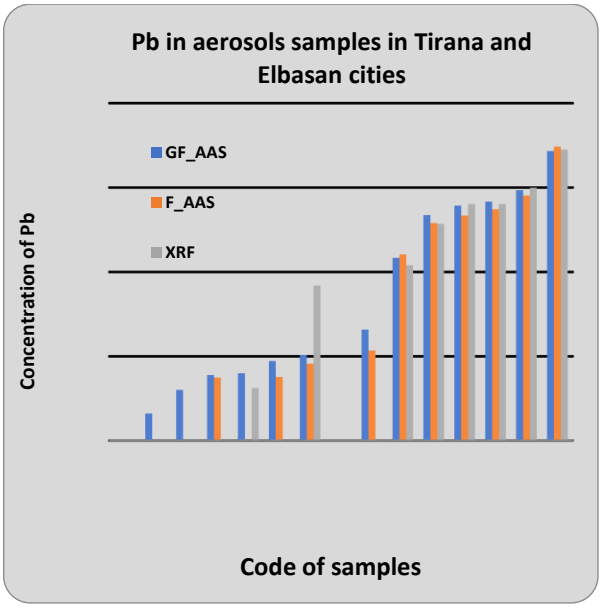

Figure 4. Lead concentration in Tirana and Elbasan

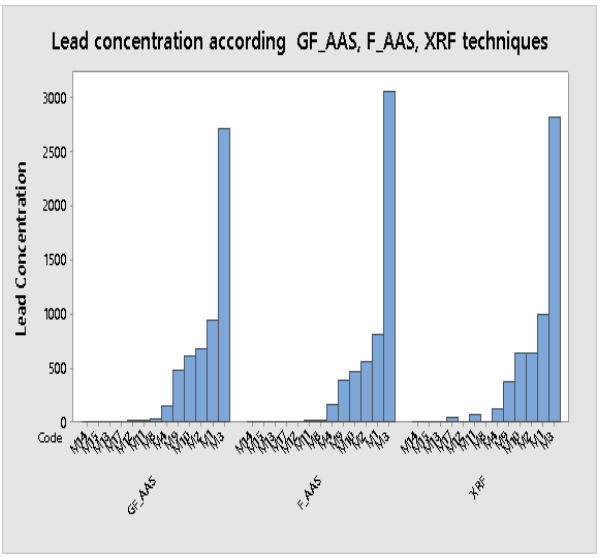

Figure 5. Compare of Lead level using three techniques

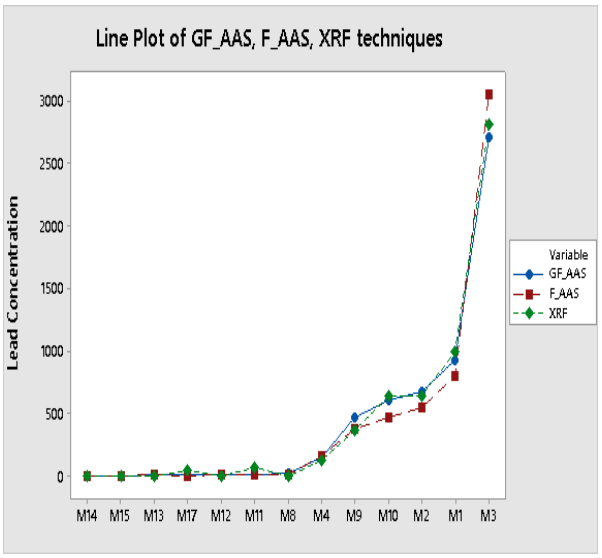

Figure 6. Line plot of lead according three techniques

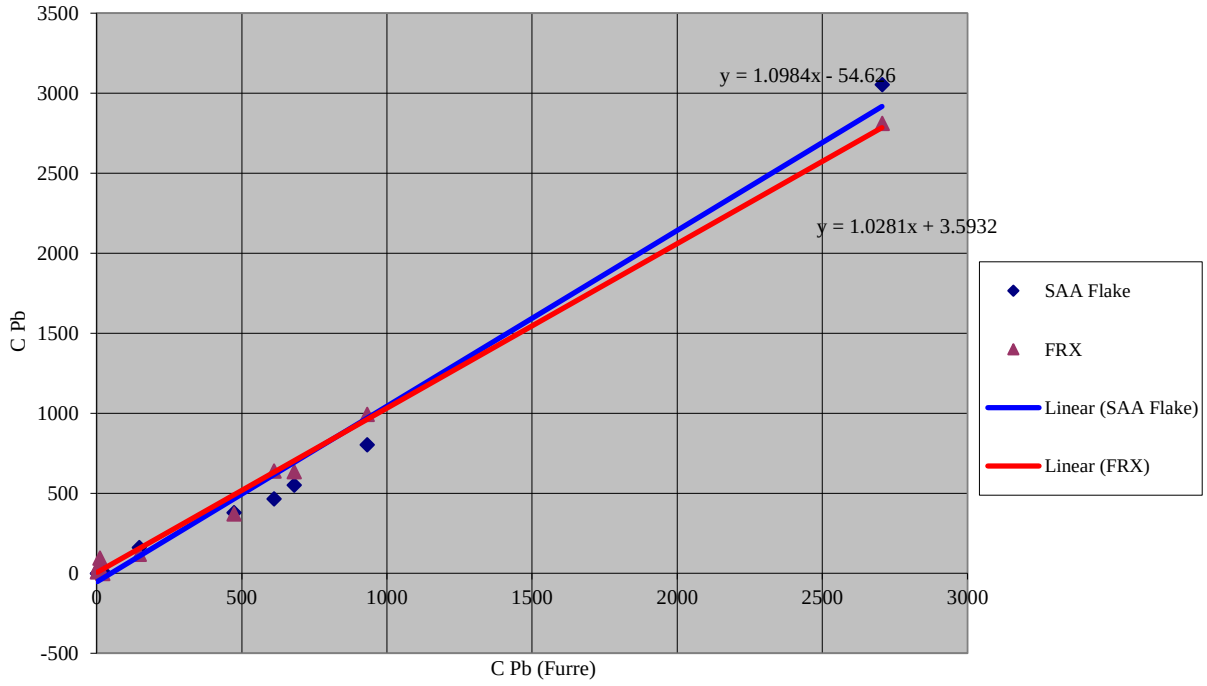

Figure 7. Concentration of lead by different techniques

4. CONCLUSIONS

In the descending order of content in aerosols, lead analyzed in selected sampling stations, were ranked as: Elbasan metallurgical >Elbasan Centre >Tirana Centre > Dajt Mount. Our obtained results have shown that the concentration of Pb in aerosols in the city of Elbasan was higher than in Tirana. The most contaminated area was near metallurgical area. The concentrations of lead determined in each method is comparable. It can be seen from the standard deviation of the values obtained for the lead in both methods was 4.3%. As the main sources of air pollution by metals in Elbasan and Tirana cities were emissions from, vehicles, burning of fuel and urban wastes, dust particles transported by wind, construction and inert materials, industrial pollution.

In the city of Elbasan partial work in Metallurgical Combine significantly contributes to the emission of gases and particle matter in the air and solid waste in the land. If the lead is present in high concentrations in the environment it presents not only negative impact on the environment but also the human health.

In the descending order of sensitivity of techniques to measure lead concentration were ranked: Graphite Furnace Atomic Absorption Spectrometry > Flame Atomic Absorption Spectrometry> Fluorescence of X-ray. The low values obtained from the Flame Technique, was the reason of low sensitivity of the instrument used, also the calculations are done manually. The Graphite Furnace Spectrometer analyzes and determines very low levels of lead in the samples at ppb levels even at trace levels, so in relatively clean samples.nTo analyze lead concentration at low levels the best technique to use is GF_AAS compare with Flame and X-ray techniques; it has the highest sensitivity.

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