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PRESENCE OF LEAD IN AIRBORNE PARTICLES: BOR REGION, SERBIA

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• Abstract

The rapid industrial development during the last century led to the appearing of airborne particles urban pollution problem. To this important problem in Serbia still has not paid enough attention. In this paper is exposed analysis of the results obtained by average annual concentration measuring of airborne particles. The content of lead was analyzed by atomic absorption spectrophotometer and inductively coupled plasma. The concentration of lead in airborne particles is monitored. Lead is a typical accumulation poisons. The results showed that the concentration of lead in airborne particles is usually within legal emission limit values.

Keywords: pollution, Bor region, air, airborne particles, lead

INTRODUCTION

The basis for people health and life is clean air. Polluted air affects on different ways of people health and on the entire ecosystem. On the air pollution problem in the world is given great attention. At the international level there are appropriate rules and guidelines that limit and not allow the broadcasting of certain chemicals and other substances into the environment. Also, in the world is stimulating plants which protect environment.

The particles in the air are dispersed substances that may be in solid or liquid physical condition and having a diameter of 0.001 microns to 1000 microns. Based on the size particles are classified into two groups: sediment and suspended particles. A group of sedimentary particles (aerosedimenta) is characterized by a larger diameter of 10 microns, while suspended particles (aerosols) have diameter less than 10 microns. Separation of particles from the air over 10 microns in diameter is performed by deposition under the influence of gravitational forces. Suspended particles have a low speed of deposition, which is also caused by the influence of gravitational forces. Since the suspended particles follow the main flows of air they remain dispersed in the air for a long time and are transmitted over long distances. Suspended particles are known as suspended particles named. Their removing from air is through rainfall [1]. The form, characteristics and effects of particulate as air pollutants are conditioned by their size. Particles smaller than 10 microns are usually spherical shape (fly ash particles and particles of biological origin).

Lead (Pb) occurs as a natural constituent of air, water and biosphere, so that certain, very small amounts people enter in the body through the respiratory system, nutrition, drinking water and skin. Whether lead is natural or unnatural, continually circulating in the biosphere and on this cycle a great influence has man. The lead concentrations in urban areas are higher during the day than at night, which probably affects the intensity of car traffic. Lead function harmful on the lungs, kidneys, blood and nervous system. It was found that on it especially children are vulnerable and in severe cases of poisoning caused by mental retarding of children. It causes the prevention of hemoglobin synthesis, neurological problems (aggressive and destructive behavior), kidney damage and even permanent brain damage [2,3]. Symptoms of lead poisoning are unpleasant sweet taste in

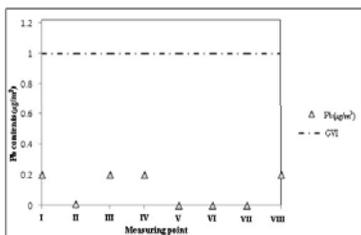


Figure 1 - Average content of lead in suspended particulate matter ($\mu\text{g}/\text{m}^3$) for the first year of study. Of the eight sampling locations, in three were not observed content of lead. It is characteristic for measuring point V, VI and VII located in rural areas around the city.

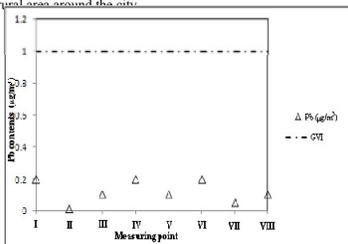


Figure 2 - Average content of lead in suspended particulate matter ($\mu\text{g}/\text{m}^3$) for the second year of study

Average content of lead in suspended particulate matter ($\mu\text{g}/\text{m}^3$) for the second year of study ranging from 0.01 $\mu\text{g}/\text{m}^3$ for measuring point II to 0.2 $\mu\text{g}/\text{m}^3$ for measuring point I, IV and VI.

the mouth, headache, vomiting and general weakness feelings. Characteristic signs of chronic poisoning are edge lead around the tooth and the occurrence of sudden cramps in the stomach.

Bor is a typical representative of cities with intense urbanization, developed infrastructure and a strong (but obsolete) industry, which is a big polluter of environment. One century of mining and copper metallurgy in Bor have had a major impact on the process of environmental degradation, both in urban and in rural areas. As the development of technological processes are not been followed with appropriate actions to prevent and reduce exhaust emissions from these plants, the city of Bor and its surroundings today casts a dark shadow on the ecological map of our country [4,5].

The paper presents the results of measurements and analysis of lead in suspended particulate matter in Bor, which were compared with the emission limit values (GVI), rules of limit values, emission measurement methods ("Gazette RS" no. 19/06).

The presence of lead in suspended particulate matter was analyzed by the measuring points according to a schedule determined and by weather conditions.

• EXPERIMENTAL

In Mining and Metallurgy Institute Bor, Department for Chemical and Technical Control, there is a group for measuring of meteorology parameters and air quality control over 30 years. By UNEP (United Nations Environment Protection) donation, two fixed stations for SO_2 monitoring (Environment SA), mobile station for ambient particulate matter concentration monitoring (PM10 particles less than 10 μm in diameter), and dust sampler for heavy metal concentration analyses in deposited matter had been arrived in Bor during summer 2003.

Sampling instrument for the determination of airborne particles consists of a sample inlet, photometer, collection medium and a flow regulated pump. Photometer uses a light scattering technique to determine the concentration of particulates in the size range from about 0.4 μm to about 20 μm in diameter. The particulate is retained by the filter which can be removed for subsequent analysis of quantities of heavy and volatile metals by ICP-AAS (Spectro Cirox Vision) and GFAAS (PerkinElmer) techniques [4].

• RESULTS AND DISCUSSION

Measuring the concentration of particulate matter is carried out periodically, at several locations, using a portable station [6]. The choice of interim monitoring points is dictated by the planned activity of production facilities and weather forecasts (the prevailing wind direction), and depends on season and state of vegetation. Regular measurements of airborne particles are of great importance for understanding the degree of air pollution in urban areas.

The content of heavy metals in suspended particulate matter is increased in measuring points that are located in the wind direction and are closer to the industrial zone. Particulate matter (particle size below 10 μm) was detected using apparatus with 24-hour samples from the ten-day measurements by location. By chemical analysis of airborne particles was determined content of Pb.

In Figure 1. is represented the average value of the Pb content in airborne particles for the first year of testing, where it is necessary to emphasize that the I-IV measuring points are located in the city, while the V-VIII measuring points are in the surrounding rural areas. From the analysis of the data we can see that there is no exceeding of a legal limit for Pb content in the city and in suburban areas.

• CONCLUSION

The serious consequences of air pollution, which have emerged in the twentieth century, stipulate demand of the air pollutants presence regular monitoring. Special emphasis is given to the introduction of effective methods and establishing a system for controlling air composition on the basis of which it can make objective evaluation of air quality. For understanding and proper monitoring of air quality needed in addition to quantitative analysis of air composition results, knowledge and physicochemical transformations of pollutants in the air under the influence of temperature, sunlight, water, oxygen from the air, germs etc.. Knowledge of the pollutants chemical transformation in the air is the basis for developing and taking measures for protection from their harmful effects.

In this paper was analyzed problem of air pollution by airborne particles in region of Bor from the aspect of Pb content. Average annual concentration of Pb in airborne particulate matter in the first and second year of investigation was below the allowable limit (GVI).

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