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CONTENTS OF Pb, Zn, Ni, Mn, Cd and Tl IN SEDIMENTARY DUST IN THE CITY OF TUZLA

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ABSTRACT
Municipality of Tuzla, according to air quality, represents a vulnerable environment in BiH for years. Emissions of gaseous pollutants and dust particles are being generated from Power Plant (TE) Tuzla, individual furnaces, chemical industry and automobile traffic. Daily monitoring of air pollution is being conducted in the city of Tuzla, but without heavy metals contents in sedimentary dust analyses. Sedimentary dust imissions tests in the area of the city were performed in order to determine the qualitative and quantitative analysis of heavy metals in sedimentnary dust. The tests found that the sedimentary dust immission ranging from 2.04 to 34.32 mg/m^{2}day. Qualitative-quantitative analysis of the sedimentary dust specifically analyzed the content of heavy metals - lead, zinc, nickel, manganese, arsenic, cadmium and thallium in sedimentary dust, whose treshold limit values were defined by the Regulations on air quality. Determined concentrations of these metals in the sedimentary dust are: the lead from 0.024 to 4.7 ppm, zinc from 6.1 to 22.68 ppm, nickel 0.642 to 2.52 ppm and manganese from 1.4 to 3.5 ppm. The presence of cadmium, thallium and arsenic has not been confirmed in sedimentary dust.
Keywords: air pollution, sedimentary dust, heavy metals

1. INTRODUCTION

Although the work of the base chemical industry in the region of Tuzla after the war significantly reduced, where pollution of all segments of environment with specific pollutants virtually disappeared, still the biggest polluter in the area of the town of Tuzla is thermal power plant (TE) Tuzla, but also the increasing number of motor vehicles, powered by liquid and gaseous fuels.
Municipality of Tuzla, for the air quality, for years represents a vulnerable environment in BiH. Gaseous emissions of pollutants and dust particles are created from TE Tuzla, but also individual furnaces, and automobile traffic. Daily monitoring of air pollution is being conducted in the city of Tuzla, but without heavy metals contents in sedimentary dust analyses. Recently, the city of Tuzla often hear accusations that the dust particles that are emitted from different sources, contain adsorbed heavy metals, which cause frequent occurrence of respiratory disease throughout the population of the city. Also the fact is that the sedimentary dust is the primary influence on the pollution of soil, especially if you have a solid dust particles on its surface adsorbed heavy metals and various organic compounds as AOX, EOX, or PAH. In order to determine the effect of these suspicions study was carried out to establish immission sedimentary dust in the area of the city for the purpose of

determination of qualitative and quantitative analysis of heavy metals in sedimentary dust. Qualitative-quantitative analysis of the sedimentary dust specifically analyzed the content of heavy metals - lead, zinc, nickel, manganese, arsenic, cadmium and thallium in sedimentary dust, whose threshold limit values were defined by the Regulations on air quality. In sedimentary dust there was determined the presence of lead, zinc, nickel and manganese. It was not determined the presence of cadmium, thallium and arsenic.

2. CASE STUDIES

The total sedimentary dust is all substances in solid, liquid and gaseous state that are not part of air, and deposit itself by the gravity or rinsing rainfalls from the atmosphere to the ground. Large particles are primary measure of visible pollution of the environment, since they are deposited on all surfaces in the human environment. Depending on the chemical composition of particles of sedimentary dust, quantity and type of adsorbed compounds, the impact of this type of dust may be more or less harmful. Sedimentary dust except that impairs the quality of air, reaches water and soil and pollutes them and thus indirectly leads to the endangerment of the environment.

Measuring the concentration of sedimentary dust was carried out using the Bergerhoff method (VDI 2119, sheet 2). Although methods of measuring means continuously measuring sedimentary dust throughout the year, when establishing the annual trend sedimentary dust concentration, the measurements, since they are intentionally aimed at proving the presence of heavy metals in sedimentary dust in the region of Tuzla, which gives them a preliminary character, were done for a period of four months. In sedimentary dust samples collected during the summer – fall period was determined the presence of heavy metals. Evaluation of the results was done according to provisions of the Regulation on limit values of air quality (Official Gazette FBiH no.12/05) where it is defined limit values (GV) for the total value of sedimentary matter and content of lead, cadmium, zinc and thallium in the total sedimentary dust (Table 1).

Table 1. Limit values of the air- GV for sedimentary dust

Pollutant substance	Sampling period	Average annual value (mg/m^2d)	High value (mg/m^2d)
Sedimentary dust -	Total one month	200	350 (remark 1)
Pb in the sedimentary dust	one month	0.1	-
Cd in the sedimentary dust	one month	0.002	-
Zn in the sedimentary dust	one month	0.4	-
Tl in the sedimentary dust	one month	0.002	-

Remark1: applies on the month in a year with the highest value of deposition/sediment

Testing sedimentary concentrations (sedimentary) dust was carried out on eight measuring stations in the city. Layout of measuring stations is shown in Figure 1

Figure 1. Site measuring station

Analysis of heavy metal concentration determination included the following elements: lead, zinc, nickel, manganese, cadmium and thallium. Content of lead, zinc, cadmium and thallium is determined by the requirements of the Rules of the quality of air and known fact that the presence of these metals adsorbed on the surface of sedimentary dust makes this dust potentially dangerous dust.
The atmosphere is a major transport medium for metals from various sources. Land is often polluting even hundreds of miles away from the emission of heavy metals.
Content of heavy metals in the sedimentary dust determined by the spectrometry ICP - OES (induced coupled plasma - optical emission system) Perkin Elmer, with the standard of 100 mg / l for lead, Pb, zinc, Zn, nickel, Ni, Mn, cadmium , Cd and thallium, Tl.

3. RESEARCH RESULTS

The results of measurement are presented in the form diagrams.

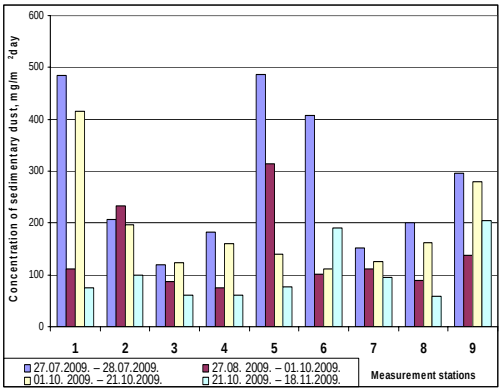

Figure 2. Diagram of movement of sedimentary dust concentration

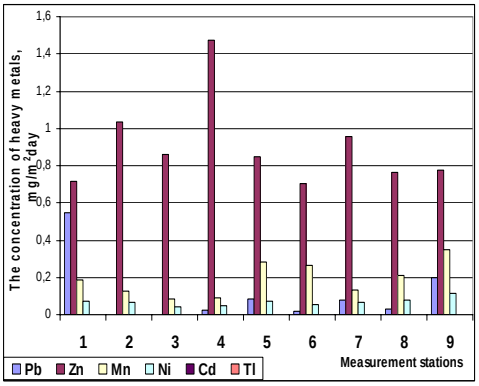

Figure 3: Content of heavy metal in sedimentary dust

4. COMMENT

Based on the results of measurements it is revealed that the highest concentration of deposited dust present in the measuring stations: 1, 5, 9 and 2, meaning in parts of the city where traffic is most intense. The determined values of dust concentration of sedimentary dust are above limit values for sedimentary powders. Measuring stations 3, 4, 7 and 8 are located on sites that are outside of the main roads in the city, and the value of sedimentary dust on them are much lower, which confirms the already known fact that traffic has a significant impact on air pollution, not only through the emission of gaseous pollutants but also through sedimentary particles. High concentrations of sedimentary dust in the first month of measurements, the measuring place number 6 located outside of the main roads, we justify by the execution of construction works preparing ground terrain and digging foundations for a residential building, just after the start of measurements, which had a direct impact on the already-set measuring point.
By analyzing the content of heavy metals in the sedimentary dust it is not found the presence of cadmium and thallium, which indicates that the sedimentary dust emitted in the city of Tuzla is not potentially dangerous in relation to these two extremely harmful elements.
As the largest source of cadmium in the process of coal combustion in the thermal power plants (TE), and the location of TE Tuzla on that aspect is well positioned in relation to the dominant winds of the city.
The largest concentration of lead in sedimentary dust is established in first measuring place (0.549 mg/m²day), whose location is near the gas station and the second measuring location (0.20 mg/m²day), whose location is at the entrance to the city and where traffic is of extreme high frequencies. Activities at the gas station, the frequency of traffic and wind frequency in these parts of the city have resulted in significant emissions of lead from motor vehicle exhaust gases, which are adsorbed on particles of sedimentary dust. The value of the concentration of lead in the sedimentary dust in these places is

above the measuring limit value of 0.1 mg/m² a day. In other places, measuring the concentration of lead is below the GV value.
Content of zinc in sedimentary dust is in all measuring stations above the limit value of 0.4 mg / m²day. This is due to acid rain resulting from the chemical reaction between SO2 from the smoke out of thermal power plant and moisture in the air. Action of acid rain on the elements of galvanized gutters, fences, roofs, windows and other structural parts comes to melting zinc and adsorption on the sedimentary dust particles. Extreme Zn loads on measuring stations 1 and 4 are explained by proximity to energy plants in the University Clinical Center which is located between the two measuring stations. Power plant uses coal with high sulfur content and there are large areas of construction elements of Zn in those areas.
Content of manganese and nickel is not standardizing for sedimentary materials. Upper limit (GV) of manganese in suspended particles up to 10 micron as well as in total particles is 2 mg/m³.The concentration of Mg and Ni in sedimentary dust in the region of Tuzla is under GV and is of anthropogenic origin as well as zinc.
Measuring station number 9 is characterized by a constant concentration of sedimentary dust and high content of heavy metals. It is explained with the proximity of TE Tuzla and very intense traffic on the exit road to the west and there is superposition of content of heavy metals in the dust extracted from multiple sources.

5. CONCLUSION

Conducted research preliminary show the present of heavy metals in sedimentary dust and it points to the logical dispersion and the impact on individual sources. Also, it leads to logical explanation of certain phenomena of heavy metals in concentrations above the GV. Legal liability is to reduce emissions of polluting material to legal values, i.e. strictly implement provisions of the Rules of limits in air emissions from combustion plants. Research suggests that in addition to TE Tuzla and other local sources that burn coal, the intense traffic in the city significantly affect the concentration of heavy metals in sedimentary dust. In order to reduce air pollution series of actions should be carried out such as substitution for the hospital complex ways of warming 'Gradina', joining individual objects to the district heating system out of TE Tuzla, the extension of green belt towards the TE and other. Particular attention should be paid to solving the problem of traffic in the city of Tuzla, and primarily on the introduction of the so-called green wave and expedited the construction of the bypass for transit traffic. Also we point to the problem of technical control and a lack of quality control of all pollutants and in particular traffic of vehicles and fuel quality of on numerous petrol stations.

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