

**AIR POLLUTION WITH POWDERS IN SUSPENSION (PM<sub>10</sub> AND PM<sub>2,5</sub>)  
IN ORADEA CITY AREA****Köteles Nandor<sup>\*</sup>, Pereş Ana Cornelia<sup>\*</sup>**

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**Abstract**

*Air pollution with powders in suspension is determined by the following activities: metallurgy and steel industry to develop into the atmosphere large quantities of such powders and thermal power plants using solid fuels and road traffic, tailings dumps and landfills, building sites, in Following demolition and household activities. The nature of these powders is very diverse. They contain either iron oxide or heavy metals (lead, cadmium, manganese, chromium) or other pollutants.*

*The purpose of this paper is to analyze the spatial-temporal variations of powders in suspension in the area of Oradea, in the present study we attempted an analysis of their evolution and the factors that require or generate them. Development was highlighted as powders in suspension in the three monitoring points, for the period 1994 - 2009, rainfall and the influence on them.*

**Key words:** pollutant, powders in suspension, the maximum permissible concentration.

**INTRODUCTION**

Material in the form of small particles - aerosol particles are solid or a liquid (aqueous) consisting of one or more chemicals that are small enough to remain suspended in the air. These particles can be in the form of: dust, smoke, soot, nitrates, asbestos, pesticides, bioaerosols (pollen, spores, bacteria cells, insect fragments, etc.). The origin of these particles may be so kind anthropogenic (biomass burning, industrial processes, traffic, agricultural activities) and natural (sand storms, dust). These particulate pollution reduces visibility in cities, industrial areas and is harmful to health, respiratory system. These particles can be classified by their weight in sediment particles (> 50 microns) and particulate matter (0.1 - 0.50 microns).

Dust with the highest grade of toxicity are lead compounds derived from spark ignition engines (road), giving 50-60% lead salts, 30-35% lead oxide. These particles are generally very heavy deposited near the emission area. Lead absorbed in high concentrations produces Saturn disease affects the brain.

Soot, smoke, carbon, are particles with a significant contribution to change in urban microclimates. The highest concentrations of soot comes from thermal power plants, chemical industry, in burns resulting from heat sources in rural and urban, etc.

The role of pollutants that it is the city in its development, both territorial and economic, it is increasingly evident, due to population growth and hence the constructed surface, road traffic and urban areas are all specific activities. Lately more and more works appear to follow developments both in space and time of atmospheric pollutants in large cities in Romania.

## MATERIAL AND METHODS

For analysis of powders in suspension in the area of Oradea city have used data from the Environmental Protection Agency Bihor. Monitoring in Oradea in three points: the Boulevard Dacia Environmental Protection Agency - Bihor, C. Coposu Street Hospital for Children and Boulevard Gen. Magheru the Environment Protection Faculty. In point of monitoring the Department of Environmental Protection observations begin in 1999, in June, from 2008 at this point there shall be monitored. Locations of monitoring was done taking into account sources of pollution concentrated in those areas.

This pollutant is considered in Oradea on a period of 16 years, respectively from 1994 to 2009. For air quality analysis are taken into account the presence and quantity of harmful, comparing the maximum allowable concentrations set by STAS 12574/1987. Maximum permissible concentrations of toxic powders in suspension are  $0.5 \text{ mg/m}^3$  for the 30 minutes and  $0.150 \text{ mg/m}^3$  for long-term measurements (24 hours). In Oradea air quality monitoring is carried out by measurements of pollutants in the atmosphere of long-term and 24 hours.

Using statistical methods - mathematical been processed data from the Environmental Protection Agency. The results were then transposed graph to clearly show the temporal variability of atmospheric pollutant.

## RESULTS AND DISCUSSION

### Annual evolution of powders in suspension

Evolution of powders in suspension in the analyzed period shows that the yearly averages in the three monitoring points is the highest value at the Faculty of Environmental Protection of  $0.047 \text{ mg/m}^3$ , and the lowest annual average powders in suspension is the point of monitoring at the Hospital for Children,  $0.037 \text{ mg/m}^3$ . These values do not exceed the maximum permissible concentration.

In the 16 years studied taking the highest values of powders in suspension were recorded in Oradea Environmental Protection Agency, as 1996 is  $0.058 \text{ mg/m}^3$ ,  $0.055 \text{ mg/m}^3$  in 2002 and in 2005 was recorded a value of  $0.056 \text{ mg/m}^3$  and the Faculty of Environmental Protection, respectively in 2005 and  $0.058 \text{ mg/m}^3$  et  $0.057 \text{ mg/m}^3$  in 1999. Lowest values of powders in suspension are the Environmental Protection Agency Oradea, in 1999,  $0.024 \text{ mg/m}^3$  respectively, and in 2001 and 2004, the value is  $0.028 \text{ mg/m}^3$ . The monitoring point at Children Hospital variation of powders in suspension is relatively constant, the highest being in 2005,  $0.046 \text{ mg/m}^3$  (see figure 1).

In point of monitoring the Faculty of Environmental Protection observations begin in 1999, in June.

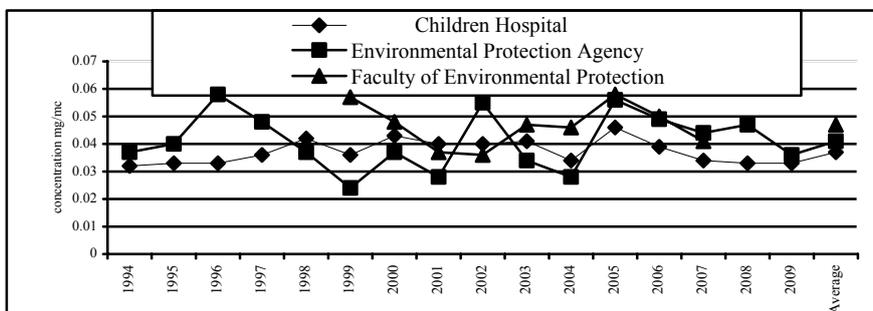


Figure 1 Evolution of annual average concentrations of powders in suspension ( $\text{mg/m}^3$ ) in Oradea monitoring points in the period 1994 to 2009

There were no exceedances of the maximum permissible limits, the values falling within the limits imposed by the STAS 12574/87.

### Monthly evolution of powders in suspension

During the reported period, powders in suspension have the highest concentrations at the Faculty of Environmental Protection, in January of  $0.064 \text{ mg/m}^3$ , and the Environmental Protection Agency in May of  $0.054 \text{ mg/m}^3$ . Lowest value recorded in September at Environmental Protection Agency Oradea,  $0.030 \text{ mg/m}^3$  respectively in July and September in the monitoring section at Children Hospital, with a concentration of  $0.031 \text{ mg/m}^3$  (see figure 2).

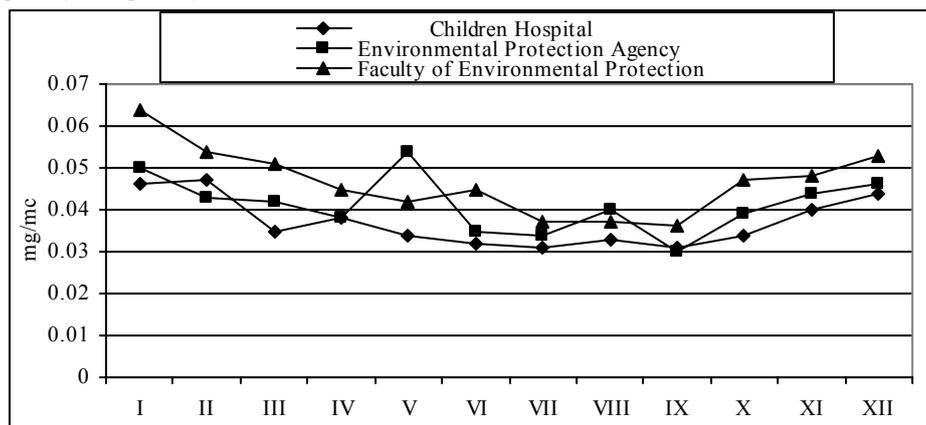


Figure 2 Variation of monthly average concentrations of powders in suspension ( $\text{mg/m}^3$ ) in Oradea monitoring points in the period 1994 to 2009

### Monthly evolution of powders in suspension in conjunction with the precipitation

Among the meteorological factors which determine the spread of powders in suspension are rainfall. Precipitation, the amount and duration, contributes largely to purify the air by dust filings that may be condensation nuclei for water vapor, leading to the formation of water droplets, which leads to falling debris from the atmosphere.

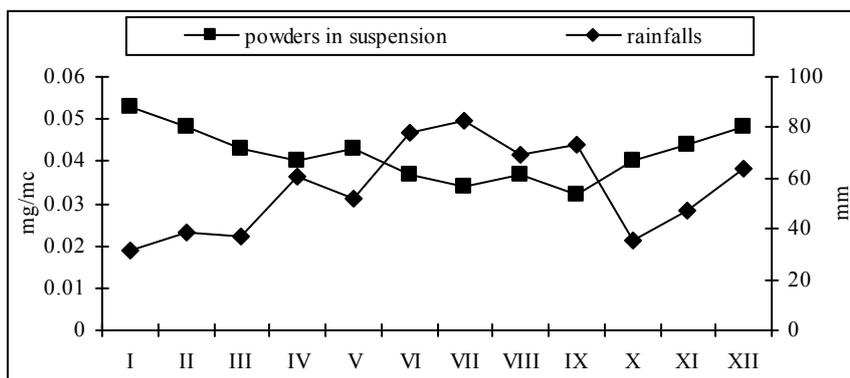


Figure 3 The evolution of monthly average concentrations for the powders in suspension and rainfalls in Oradea city

Linking the two phenomena, the evolution of the quantity of powders in suspension and rainfall, is shown in Figure 3, the graph results in a backwards walk between these phenomena. Smallest amount of particulate matter recorded in the warm season, when rainfall is highest. The largest amount of particulate matter recorded in winter, in January ( $0.053 \text{ mg/m}^3$ ), when rainfall is lowest of the year (31.8 mm). This emphasizes the role of precipitation for purifying air.

## CONCLUSIONS

For the reported period the average values of powders in suspension in the area of Oradea, did not exceed the maximum permissible concentration than incidentally, a very short period of time. This has contributed towards the prevailing wind in the southern direction, which favors the dispersion of pollutants.

Powders in suspension have the highest concentrations in January, when rainfall recorded the lowest value of the year, while the lowest concentrations occur in the warm season, when rainfall is highest. This emphasizes the role of precipitation for purifying air.

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