

THE LEVEL OF AIR POLLUTION WITH SEDIMENT PARTICLES IN BIHOR COUNTY IN 2014-2015

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Abstract

This paper presents the study conducted on sediment particles in Bihor county over a period of two years (2014-2015). The data were obtained from the Bihor County Environmental Protection Agency, which monitors the level of pollution with sediment particles in 14 sampling points spread throughout the county. The samples were collected on a monthly basis. The sampling points are grouped in three areas: First area (the northwest of the county): Tărian, Biharia, Sălard, Episcopia Bihor; Second area: 1st May Spa, Oradea Weather Station, Oradea Environmental Protection Agency; Third Area: Telechiu, Chistag, Peştera, Aleşd, Aştileu, Subpiatră, Ţeţchea. These areas are located within the perimeter of Bihor county, where the most important pollution sources can be found.

The role of these monitoring places is to identify polluted areas and to take strategic measures to get rid of pollution.

Key words: maximum permissible concentration, monitoring, sampling points, sediment particles

INTRODUCTION

Polluting sediment particles in the air can come from different sources. The most important polluters are the metallurgical and steel industries, which, during industrial processes, emit high quantities of particles. Solid fuel power plants, cement factories, road transport, waste and sterile dumps etc. are also important sources of sediment particle pollution.

A high number of studies have been conducted on pollution of air with solid particles in Bihor county (Petrea, 2001; Măhăra, Dudaş, Gaceu, 2003; Moza, 2009; Moza, Köteles, 2010; Pereş, 2011; Pereş, Köteles, Pârloiu, 2011; Pârloiu, Köteles, 2013).

MATERIAL AND METHODS

In the study conducted on the pollution of air with sediment particles in Bihor county data from the Bihor County Environmental Protection Agency were used. This institute monitors air quality in Bihor county (www.apmbh.ro).

In the area of Bihor county there are 14 sampling points, where samples are collected on a monthly basis. The sampling points are grouped in three strategic areas:

- First area (the northwest of the county): Tărian, Biharia, Sălard, Ep. Bihor;
- Second area: 1st May Spa, Oradea Weather Station, Oradea Environmental Protection Agency;
- Third area: Telechiu, Chistag, Peștera, Aleșd, Aștileu, Subpiatră, Țețchea.

The evolution of sediment particle concentrations was analyzed over a period of two years, 2014-2015. According to STAS 12574/1987 and Ordinance 592/25.06.2002, the maximum allowed concentrations of sediment particles are 17 g/m²/month.

RESULTS AND DISCUSSION

Annual evolution of sediment particles

The sediment particle concentration data for 2014 show that the highest concentration was recorded at the sampling point in Sălard, that is, 7.584 g/m². A high value was also measured in Episcopia Bihor, 6.980 g/m², but the maximum allowed concentration was not exceeded. The level of pollution has rather little variations at the other sampling points, with a concentration of 4.872 g/m² at the Oradea Environmental Protection Agency and 2.779 g/m² in Aleșd.

Lower concentrations were recorded in Aștileu and Țețchea, values of 3.129 and 3.196 g/m² respectively (see Figure 1).

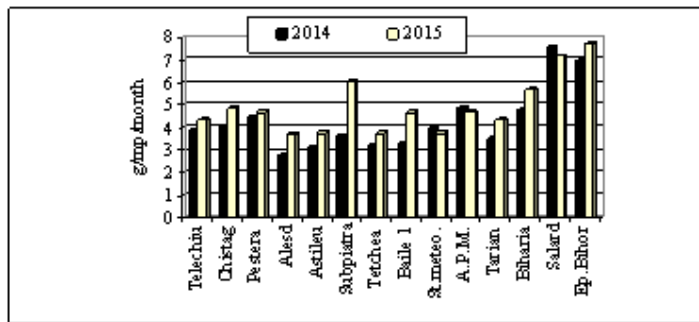


Fig. 1. The evolution of sediment particle mean concentrations in Bihor county, 2014-2015

The sediment particle concentrations for 2015 were similar to those of 2014, the highest values were recorded at the sampling points in Episcopia Bihor and Sălard, 7.734 and 7.193 g/m² respectively, but the maximum allowed concentration was not exceeded. A value close to those two above was recorded at the sampling point in Subpiatră, 6.052 g/m². The lowest values were those in Aleșd, 3.698 g/m², Aștileu, 3.767 g/m², Oradea Weather Station, 3.778 g/m², and Țețchea, 3.782 g/m².

Comparing the two years included in the study, it can be seen that the level of pollution shows little changes, a higher value was recorded in 2015 at the Subpiatră sampling point, 6.052 g/m², against 3.681 g/m² in 2014.

In the two years of the study, the mean concentration of sediment particles reaches the highest level of pollution at the Sălard and Episcopia Bihor sampling points, 7.389 g/m² and 7.357 g/m² respectively. The following sampling points with higher pollution levels are Biharia, 5.256 g/m², Subpiatra, 4.867 g/m², and the Bihor County Environmental Protection Agency, 4.799 g/m². The lowest annual mean concentrations of sediment particles were recorded in Aleșd, 3.239 g/m², Aștileu, 3.448 g/m², and Țețchea, 3.489 g/m² (see Fig. 2).

The above figures show that in 2014-2015 the level of pollution with sediment particles did not reach 17 g/m²/month.

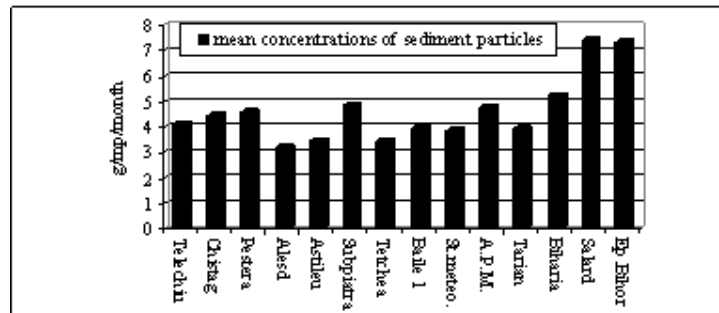


Fig. 2. The evolution of multiannual (2014-2015) mean concentrations of sediment particles at the 14 sampling points in Bihor county

The monthly evolution of sediment particles

The analysis of the monthly evolution of sediment particles shows that the mean concentration of the 14 sampling points reaches the highest value in April 2015, 7.812 g/m², and in June 2015, 7.010 g/m², followed by a concentration of 5.634 g/m², reached in October 2014 (see Fig. 3). The lowest concentrations of sediment particles were recorded in June and February and April 2014, 2.827 g/m² and 3.109 g/m² respectively.

The results show that at the 14 sampling points the maximum allowed concentration was not exceeded.

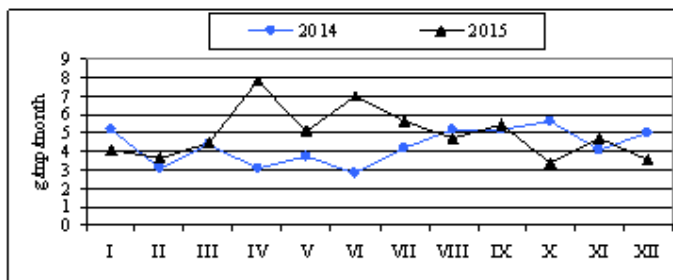


Fig. 3. The monthly pattern of sediment particles in Bihor county (the mean of the 14 sampling points)

Looking at the monthly evolution over the two years, the mean of the 14 sampling points shows that the highest level of pollution with sediment particles was recorded in April, a value of 5.461 g/m^2 , followed by September with 5.318 g/m^2 and August, 4.959 g/m^2 . The lowest value is that of February, 3.394 g/m^2 (see Fig. 4).

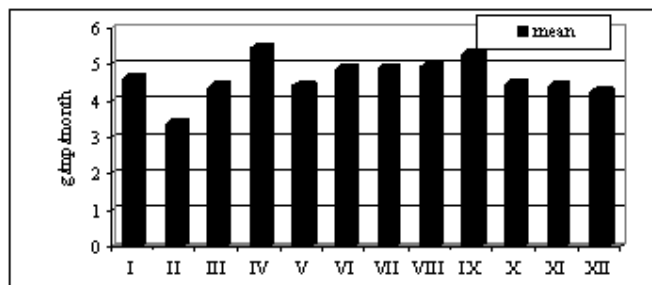


Fig. 4. The evolution of multiannual monthly concentrations of sediment particles in Bihor county (the mean of the 14 sampling points)

Geographical distribution of sediment particles

The area with the highest concentration of sediment particles was the first one, where the highest values were recorded in 2015, 6.245 g/m^2 , while in 2014 the concentration was 5.710 g/m^2 .

In the other two areas, in 2015 the concentrations of particles were almost the same, with values of 4.047 g/m^2 in the second area and of 4.395 g/m^2 in the third one. The lowest values were reached in the third area in 2014, a concentration of 3.598 g/m^2 (see Fig. 5).

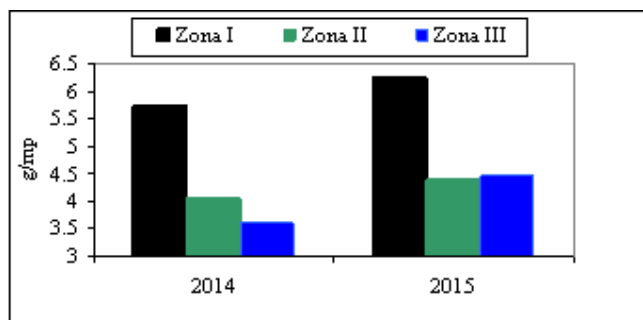


Fig. 5. The evolution of the annual mean concentrations of sediment particles in the three areas of Bihor county, 2014-2015

The mean of the two years included in the study shows that the highest concentrations of sediment particles are reached in the first area, the value of 5.357 g/m^2 , which can be explained with the first area being in the vicinity of the industrial area of Oradea. In the second area, the concentration of sediment particles is 4.221 g/m^2 , and the lowest concentration of sediment particles can be found in the third area, 4.026 g/m^2 (see Fig. 6).

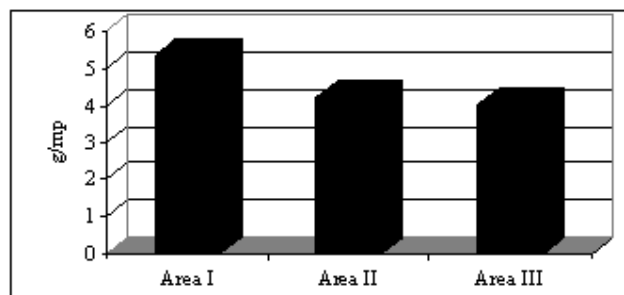


Fig. 6. The distribution of the multiannual mean concentrations of sediment particles in the three areas of Bihor county, 2014-2015

CONCLUSIONS

It can be concluded that the highest concentration of sediment particles is recorded in the industrial area of Oradea (first area of the study), but these concentrations do not exceed the maximum allowed values ($17 \text{ g/m}^2/\text{month}$).

The concentration of sediment particles had the lowest values in the cold season of the year, while the highest values were recorded in the summer months, which is due to the fact that this is the period with the highest precipitation amounts.

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