ANALYSIS OF THE LEVEL OF POLLUTION WITH PARTICULATE MATTER PM 10 IN THE AREA OF BIHOR COUNTY IN 2020 – 2022

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RESEARCH ARTICLE

Abstract

In this paper we studied the level of pollution with particulate matter PM 10 , in the area of Bihor County in the years 2020 – 2022. The data were processed from the Environmental Protection Agency Bihor Oradea, which is responsible for monitoring air pollution in Bihor County. Four air monitoring stations are located in Bihor County. A station to find inside the premises of the A.P.M. Bihor Oradea BH_1 is an urban station. The second station is located in the Bihor BH_2 Episcopia Bihor and is an industrial station. The third station is in Nufarul near McDonalds-drive BH_3, it is a traffic station, and the fourth station is in Ţeţchea BH_4 is an industrial station. In the period considered 2020 – 2022, the level of particulate matter pollution is within the normal range and the maximum permissible concentrations of 50 /m³ have not been exceeded. However, from daily observations, one can observe exceedances of the maximum permissible concentration, but these overruns lasted for several days.

Keywords: sedimentable particulate matter, monitoring, sampling points, maximum permissible concentration
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INTRODUCTION

Particulate matter PM 10 are formed from a complex mixture of very small particles and droplets of liquid, they are formed in the atmosphere following complex reactions of chemicals.

In the long run, these particles can have negative health effects. The suspended particles PM 10 have a diameter of less than 10 micrometers and are of two natural and artificial kinds.

In some cases, these suspended powders may contain carbon particles, heavy metals, toxic pollutants, etc.

MATERIAL AND METHOD

The data used to carry out this study are used from the Environmental Protection Agency Bihor Oradea. For pollution surveillance in Bihor County, four sampling stations are located.

Sampling stations are located in strategic places BH_1 is located in the headquarters of A.P.M. Bihor Oradea, Dacia Boulevard no. 25/A being urban station, BH_2 in Episcopia Bihor, street Matei Corvin no.106/A, industrial station. BH_3 is located in the Nufarul Quarter, near McDonalds-drive and is a traffic station. And value of 7.99 g/m², followed by September 7.75 g/m² and May 7.57 g/m².

In 2022 the highest concentration of sediment particles concentrations were in BH_4 station is located in Ţeţchea, being an industrial station (www.apmbh.ro).

In this paper we studied the variations, the level of particulate matter PM 10, between 2020 – 2022. The limit value for particulate matter PM10, according to Law no. 104/2011 on ambient air quality is the daily average value of 50 µg/m³ (STAS 12574/1987).

RESULTS AND DISCUSSIONS

1. Annual evolution of particulate matter PM 10

Following the analysis of the particulate matter concentrations PM 10, it follows that in 2020 the highest concentration was determined at the sampling point of Ţeţchea BH_4 of 25.51 µg/m³ and 19.11 µg/m³ at the point located in Nufarul BH_3, and the lowest value was recorded at APM Oradea BH_1 (17.56 µg/m³).

For 2021 the highest concentration was recorded at APM Oradea BH_1 19.31 µg/m³, followed by BH_4 Station Ţeţchea 18.06 µg/m³.

In the last year studied (2022) the highest concentration of PM 10 powders was determined at APM Oradea BH_1 33.91 µg/m³, followed by 18.06 µg/m³, respectively, the BH_4 Ţeţchea (Figure 1).

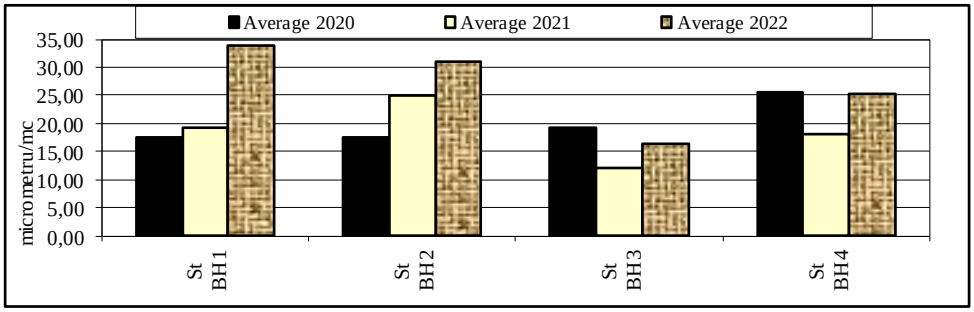

Figure 1**. The evolution of suspended particulate matter average concentrations in Bihor county, 2020 – 2022**

From the analysis of the multi-annual average concentrations it follows that the highest value was determined at the BH_2 station in Episcopia Bihor, of 23.15 µg/m^3, followed by 21.53 µg/m^3 at APM BH_1.

Lower values were determined at the sampling points in Țețchea (19.74 µg/m^3) and Nufarul (15.43 µg/m^3) (Figure 2).

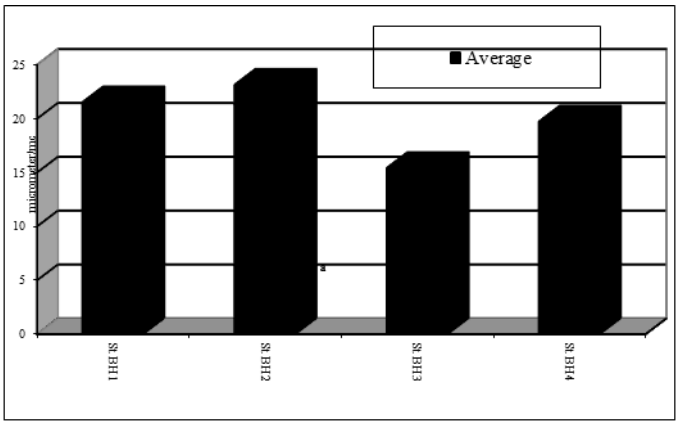

Figure 2. **Evolution of the multiannual average concentrations (2020– 2022) of suspended particulate matter PM 10 at the 4 monitoring points in Bihor county**

2. Monthly evolution of suspended particulate matter PM 10

From the average concentration of sampling points for the period studied (2020 - 2022), it follows that in 2020 the highest concentrations were recorded in January of 29.01 µg/m^3, in October of 28.00 µg/m^3 and 27.00 µg/m^3 in November. At the opposite pole is June with the lowest concentration of 6.60 µg/m^3.

The highest values for 2021 were determined in February by 38.13 µg/m^3, 27.15 µg/m^3 in December and 25.47 µg/m^3 in March. The lowest value was recorded in August of 8.28 µg/m^3.

The highest concentrations in 2022 were determined in May 37.51 µg/m^3, in January 35.96 µg/m^3 and in April 24.21 µg/m^3. No samples were taken from July to December due to technical problems (Figure 3).

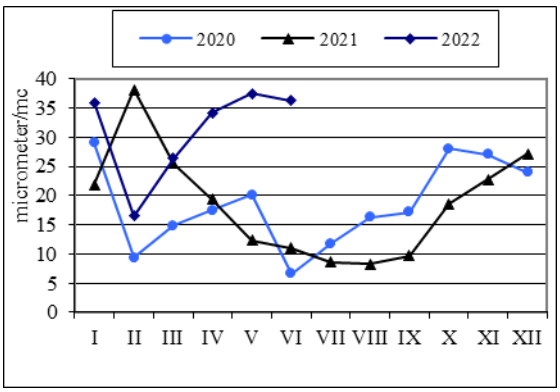

Figure 3. **Monthly pattern of suspended particulate matter in Bihor county (the average of the 4 sampling points)**

From the analysis of the multiannual mean concentrations of particulate matter PM 10 for the three years studied, we can conclude that the highest concentrations resulted in December with a concentration of 25.57 µg/m^3 and in November 24.88 µg/m^3. The lowest values were recorded in June (10.19 µg/m^3), July (12.27 µg/m^3) and August (13.47 µg/m^3) (Figure 4).

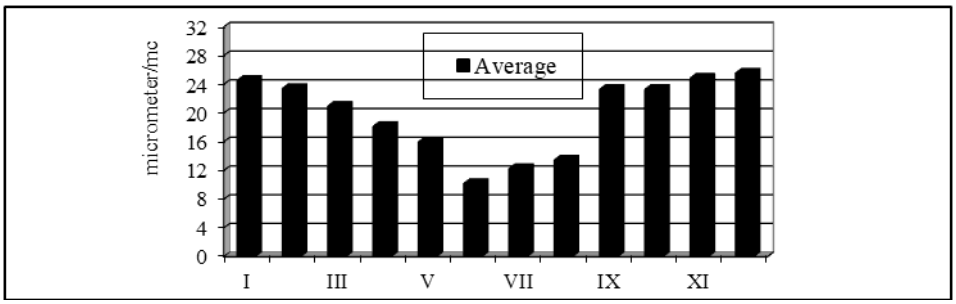

Figure 4. **The evolution of multiannual monthly average concentrations of suspended particulate matter in Bihor (the average of the 4 sampling points)**

3 Evolution of particulate matter pollution PM 10 at sampling points

At the sampling point within A.P.M. Bihor BH_1 in 2020 the highest value was recorded in December of 25.76 µg/m^3, in November of 25.63 µg/m^3 and in October of 19.93 µg/m^3.

During 2021 the highest concentrations were recorded in February of 36.64 µg/m^3, in December of 34.74 µg/m^3 and in November of 30.13 µg/m^3.

In the last we took into study the highest values were recorded in January of 39.48 µg/m^3, but this year's 2022 data is incomplete because in July - December for technical reasons no determinations were made (Figure 5).

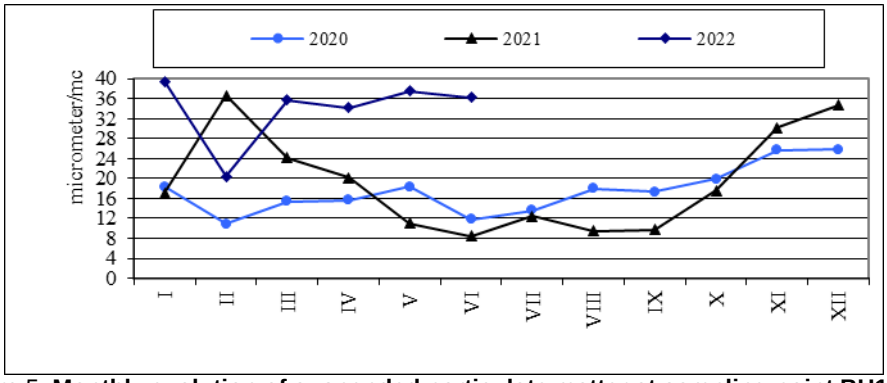

Figure 5. **Monthly evolution of suspended particulate matter at sampling point BH1**

Table 1

Valorile depășirilor la stația de prelevare BH_1

Sampling point	Year	Month	Day	The values µg/m³	Sampling point	Year	Month	Day	The values µg/m³
BH 1	2021	January	10	52.70	BH 1	2022	January	15	63.25
			16	61.07				16	65.60
		February	8	53.51					
			20	63.41					
			21	73.56					
			22	59.06					
			24	100.71					
			25	80.43					
			26	78.51					
		March	3	58.01					
			4	52.71					
			5	51.99					
			26	61.54					
		December	15	61.56					
			16	58.71					

Following the analysis of the particulate matter PM 10 concentrations per day at the BH1 sampling point in 2020, no exceedances of the maximum permissible concentration of 50 µg/m^3 were recorded. However, in 2021, there were 15 exceedances of the maximum permissible concentration. There were 2 overtakes in 2022 (Table 1).

The highest concentration value of the particulate matter PM 10 at the BH_2 sampling station in Episcopia Bihor was determined in December 2020 (27.07 µg/m^3). In January – March no determinations were made.

In 2021 high value was determined in February of 53.97 µg/m maximum allowable concentration being exceeded.

In 2022 determinations were made only in January – March, the highest being in January 46.98 µg/m (Figure 6).

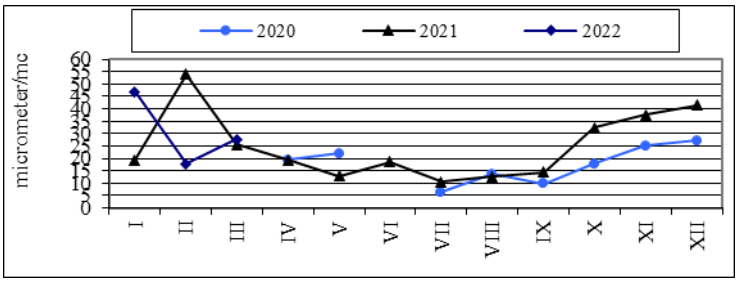

Figure 6 **Mersul lunar al pulberilor în suspensie PM 10 la stația de prelevare BH_2**

At the BH_2 monitoring point, in 2021, 17 overshootings were observed in 2022, respectively, 12 overshootings of the maximum permissible concentration of 50 µg/m^3 (Table 2).

Table 2

Values of overshoots at the sampling station BH_2

Sampling point	Year	Month	Day	The values µg/m³	Sampling point	Year	Month	Day	The values µg/m³
BH_2	2021	February	18	52.02	BH_2	2022	January	8	55.03
		October	26	54.05				9	53.75
			27	64.57				13	90.00
			28	76.05				14	91.34
			30	65.75				18	62.31
			31	53.05				19	75.18
		November	9	55.75				20	56.18
			12	64.57				24	56.20
			13	76.05				25	72.40
			14	65.75				26	67.41
			15	76.54				27	57.30
			16	100.35			February	26	52.75
			17	70.55					
			18	69.51					
			19	76.54					
		December	13	54.08					
			14	92.10					

At the BH_3 monitoring station in Nufarul district, the highest level of particulate matter concentration for 2020 was determined in October by 28.58 µg/m^3 followed by November of 25.76 µg/m^3.

In 2021 the highest concentration level was reached in February by 28.70 µg/m^3 and in March by 24.76 µg/m^3. For 2022 observations were made only in the first three months of the year (Figure 7).

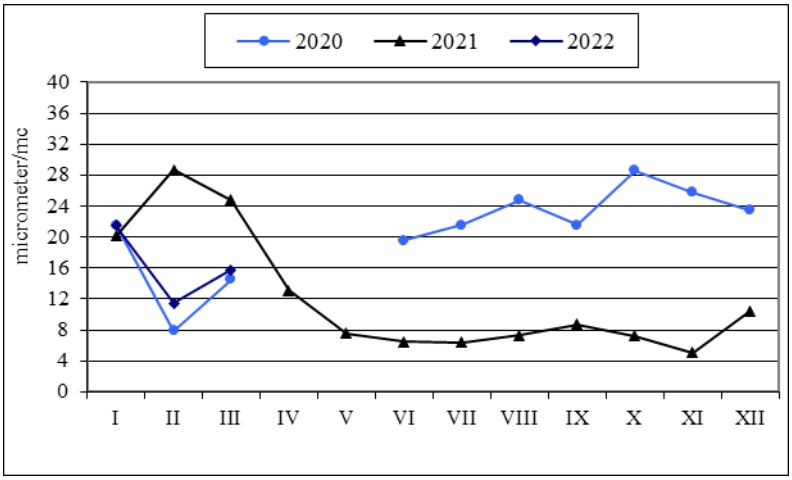

Figure 7 **Monthly evolution of suspended particulate matter at sampling point BH3**

At this BH_3 sampling point in the years studied there were no exceedances of the maximum permissible concentration.

The level of PM 10 particulate matter concentration in Ţeţchea, BH_4 for 2020 the highest was determined in January by 47.13 µg/m^3 followed by October of 45.70 µg/m^3. It is worth mentioning that between February – June for technical reasons no measurements were made.

In 2021 high concentration was determined in February by 33.21 µg/m^3, followed by 30.77 µg/m^3 in January.

The observations made for 2022 were only on three months January – March, the highest concentration was in January 21.46 µg/m^3.

At the BH_3 monitoring point no exceedances of the maximum permissible concentration occurred (Figure 8).

The maximum permissible concentration at the BH_4 station in 2020 was exceeded 12 times, repeatedly in 2021 only once (Table 3).

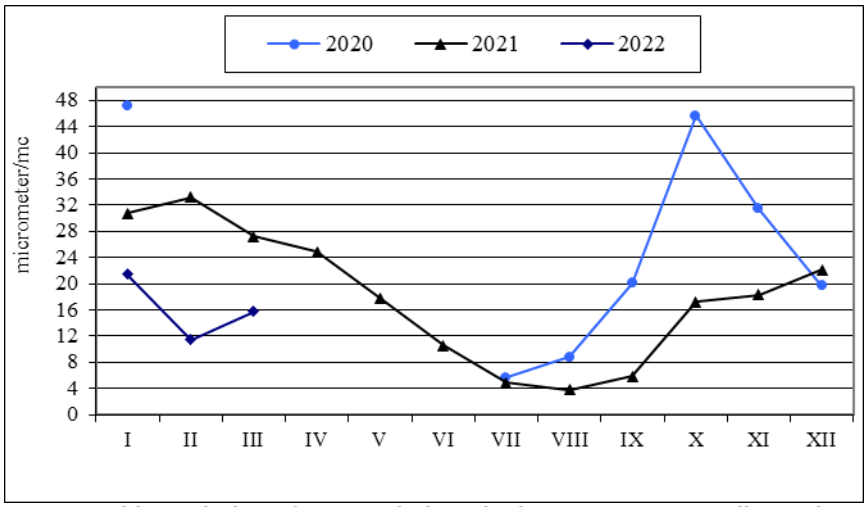

Figure 8 **Monthly evolution of suspended particulate matter at sampling point BH4**

Table 3

Values of exceedances at the sampling station BH_4

Sampling point	Year	Month	Day	The values µg/m³
BH_4	2020	January	8	50.30
			10	67.18
			11	81.54
			12	64.69
			18	78.66
			19	66.53
			20	60.04
			21	53.75
		October	23	68.51
			24	58.05
			27	51.60
	2022	January	15	64.75

CONCLUSIONS

Following the analysis of the particulate matter PM 10 pollution over the period considered 2020 to 2022, at the four monitoring points we can conclude that the variations in the mean and multiannual concentrations, annual and multiannual monthly averages The maximum permissible concentration of 50 µg/m³ has not been exceeded.

On daily measurements at the 4 sampling stations were signaled overruns in 59 days. These overruns were mostly recorded in the cold season of the year, as homes are heated predominantly with wood and coal, resulting in more particulate matter pollution.

Important factor in the pollution of suspended powders are also weather conditions, and atmospheric calmness, lack of winds can lead to stagnation of dust in the atmosphere.

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