THE LEVEL OF AIR POLLUTION WITH NITROGEN DIOXIDE IN THE CITY OF SATU-MARE IN 2018-2022

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Abstract

This paper studies the level of air pollution of nitrogen dioxide for the years 2018 – 2022 in Satu-Mare. Data on pollutant monitoring were provided by Satu -Mare Environmental Protection Agency.

Within Satu-Mare there are 4 nitrogen dioxide sampling points. The four points are strategically located in the city area, in the central area at APM Satu-Mare headquarters, in the high-traffic area Drumul Carei and the industrial areas on Şoimoşeni Street and Magnoliei Street.

From the analysis of the five years (2018 -2022) taken into account, we can admit that the maximum permissible concentration of 100 µm/mc was exceeded 33 times.

Keywords: Nitrogen dioxide, monitoring, harvesting points, maximum permissible concentration.
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INTRODUCTION

The most important sources of air pollution with nitrogen dioxide result from the combustion of fossil fuels, as well as from the combustion of fuels in engines.

For these reasons, exceeded of the maximum permissible concentration can occur, which over time can have a direct impact on our health and mortality.

The problem of nitrogen dioxide pollution has been studied by several authors, Pereş, 2011 and Köteles, 2016.

MATERIAL AND METHOD

In the study of assessing the level of air pollution with nitrogen dioxide, we used data provided by the Environmental Protection Agency Satu-Mare (www.apmsm.ro).

The agency has installed 4 sampling points in Satu-Mare located as follows: in the central area at APM Satu-Mare headquarters, in the industrial area on Şoimoşeni Street located in the north of the city, in the industrial area on Magnoliei Street and in the Burdea – Drum Careiului intersection area.

Through these monitoring points, the evolution of the level of nitrogen dioxide pollution over a period of 5 years (2018 - 2022) was monitored.

The maximum permissible concentration for nitrogen dioxide is 100 µm/mc (STAS 12574/1987, Order 592/25.06.2002).

RESULTS AND DISCUSSIONS

1. Annual evolution of nitrogen dioxide

The highest concentration of nitrogen dioxide for 2018 was recorded at 43.47 µm/cubic meter, at the Drum Carei sampling point.

Followed by 30.34 µm/mc recorded at the sampling point in Şoimoşeni Street and 22.26 µm/mc at Magnoliei Street station.

The lowest value of nitrogen dioxide concentration for 2018 was determined at the headquarters, being 15.94 µm /mc.

In 2019, the highest value was determined at the sampling point in Şoimoşeni Street 55.16 µm/cubic meter, followed by 50.03 µm/cubic meter at Drum Carei point. The lowest value being measured at headquarters of 13.90 µm/mc.

The highest values were determined for 2020 at Şoimoşeni Street station of 66.84 µm/mc, of 46.34 µm/mc at Drumul Carei point. The lowest value was determined at the headquarters (25.69 µm/mc).

In 2021, the maximum concentration determined was 41.61 µm/mc at Drum Carei station, followed by 38.90 µm/mc at Şoimoşeni Street. The lowest value of 31.18 µm/mc was determined at headquarters.

For 2022, the highest values were recorded at Drumul Carei points of 45.98 µm/mc and 45.02 µm/mc at the point in Şoimoşeni Street.

From the analysis of the evolution of carbon dioxide concentrations for the years 2018 – 2022, we can find that the maximum

permissible concentration has not been reached (Figure 1).

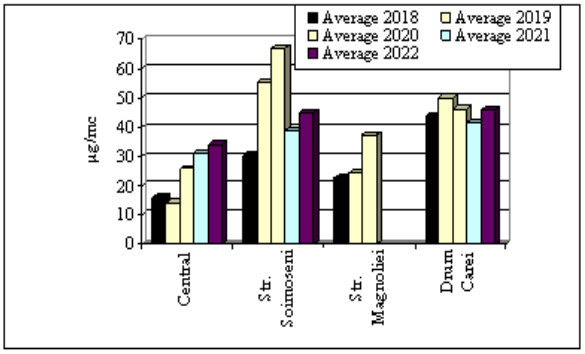

Figure 1. **The evolution of average nitrogen dioxide concentrations in Satu-Mare, during 2018-2022**

From the analysis of the average of the five years (2018 - 2022) results that the highest concentration was determined by the station Şoimoşeni Street of 47.25 µm/mc, followed by 45.49 µm/mc (Drum Carei) and 27.81 µm/mc Magnoliei Street. And the lowest value was determined at the headquarters of 24.19 µm/mc (Figure 2).

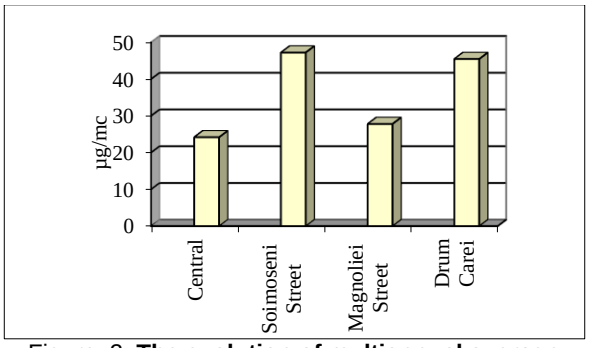

Figure 2. **The evolution of multiannual average concentrations (2018 – 2022) of nitrogen dioxide in the 4 monitoring points in Satu-Mare**

2. Monthly evolution of nitrogen dioxide

From the analysis of the four sampling points, the highest average concentrations for 2018 were recorded in February, a value of 30.47 µm/mc, followed by February of 19.97 µm/mc and September of 18.40 µm/mc. The lowest values were determined in March 10.65 µm/mc, June (11.30 µm/mc) and December 12.61 µm/mc.

In 2019, the highest value was determined in August 25.78 µm/mc. This is followed by September (21.78 µm/mc) and October 17.11 µm/mc. While the lowest values were reached in May (8.95 µm/mc), December (9.19 µm/mc) and November (9.56 µm/mc).

For 2020, the highest concentration was determined in February 51.04 µm/mc, 34.50 µm/mc in March and 33.14 µm/mc in August.

The lowest concentrations were in April (12.05 µm/mc), May (15.28 µm/mc) and June (17.24 µm/mc). No concentrations were determined for technical reasons in September, October, November and December.

In 2021, also for technical reasons, nitrogen dioxide was not determined only in October 30.78 µm /mc and November 31.58 µm /mc.

In the analysis of 2022, the highest values were determined in June 43.23 µm/mc, January 39.38 µm/mc and February 38.57 µm/mc. The lowest values were observed in September 26.63 µm/mc, August 29.63 µm/mc and 29.73 µm/mc (Figure 3).

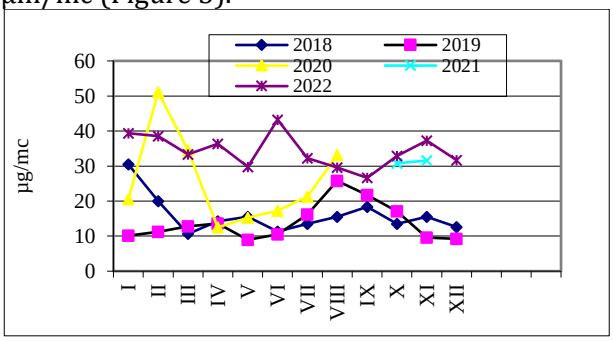

Figure 3**. Monthly flow of nitrogen dioxide to the 4 sampling points in Satu-Mare, during the period 2018 – 2022 (average of the 4 points)**

From the analysis of the monthly evolution of the years 2018 – 2022, the average of the four observation points, results that the highest degree of pollution with nitrogen dioxide was reached in February 44.20 µm/mc, followed by December 43.40 µm/mc and January 39.75 µm /mc (Figure 4).

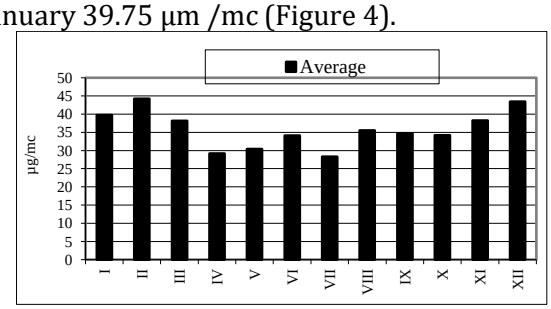

Figure 4. **The evolution of the multiannual monthly average concentrations of nitrogen dioxide in Satu-Mare(average of 4 points)**

And the lowest values were determined in July 28.30 µm/mc, April 29.18 µm/mc and May 30.39 µm/mc.

3. Daily evolution of nitrogen dioxide

The daily analysis of the level of nitrogen dioxide pollution for 2018 shows that 921 determinations were made at the four monitoring points (Central, Şoimoşeni Street, Magnoliei Street, Carei Road). At the sampling point on Magnoliei Street, there were three

exceeded of the permissible concentrations, which is 100 µm/mc.

The value of these exceeded being 153.70 µm/mc, 163.34 µm/mc and 171.47 µm/mc (see table 1).

Table 1

Number of determinations, exceeded and maximum recorded value of nitrogen dioxide in Satu-Mare, in 2018

Sampling points/ month	Number of determinations	Magnoliei Street	
		Number of exceeded	Exceeded values µg/mc
I	76	0	0
II	76	0	0
III	82	0	0
IV	72	0	0
V	77	0	0
VI	74	0	0
VII	84	0	0
VIII	70	0	0
IX	78	0	0
X	88	0	0
XI	77	0	0
XII	67	3	171.47 153.70 163.34

In 2019, 91 determinations were made, and 13 exceeded took place. Four exceeded at the sampling point in Şoimoşeni Street, eight exceeded at Magnoliei Street and one overtaking at Drum Carei (see table 2).

The daily evolution of nitrogen dioxide in 2020, resulting from 492 determinations, 14 exceeded were recorded. Ten exceeded were recorded at the sampling point on Magnoliei Street, in January there were two exceeded of 137.80 µm/mc and 128.43 µm/mc.

In February there were four exceeded (143.16 µm/mc, 140.32 µm/mc, 136.57 µm/mc and 118.90 µm/mc), and in March also four exceeded (193.80 µm/mc, 185.65 µm/mc, 150.14 µm/mc and 132.24 µm/mc). At the sampling station on Şoimoşeni Street, there were four exceeded in July (131.76 µm/mc, 129.67 µm/mc, 119.47 µm/mc and 112.52 µm/mc) (see table 3).

In 2021, out of 191 determinations carried out in October, November and December, there were no exceeded of the maximum permissible concentration.

Table 2

Number of determinations, exceeded and maximum recorded nitrogen dioxide in Satu-Mare city, in 2019

Sampling points/ month	No. of deter.	Şoimoşeni Street		Magnoliei Street		Drum Carei	
		No. of exceeded	Exceeded values µg/mc	No. of exceeded	Exceeded values µg/mc	No. of exceeded	Exceeded values µg/mc
I	73	0	0	0	0	0	0
II	71	4	220.16 170.42 167.80 140.23	5	223.41 216.32 180.43 150.37 132.40	0	0
III	75	0	0	0	0	0	0
IV	74	0	0	0	0	1	162.61
V	73	0	0	0	0	0	0
VI	75	0	0	0	0	0	0
VII	88	0	0	0	0	0	0
VIII	72	0	0	0	0	0	0
IX	75	0	0	0	0	0	0
X	80	0	0	0	0	0	0
XI	78	0	0	2	117.67 110.13	0	0
XII	67	0	0	1	104.26	0	0

Table 3

Number of determinations, exceedances and maximum recorded nitrogen dioxide in Satu-Mare city, in 2020

Sampling points/ month	No. of deter	Şoimoşeni Street		Magnoliei Street	
		No. of exceeded	Exceeded values µg/mc	No. of exceeded	Exceeded values µg/mc
I	76	0	0	2	137.80 128.43
II	77	0	0	4	143.16 140.32 136.57 118.90
III	67	0	0	4	193.80 185.65 150.14 132.24
IV	30	0	0	0	0
V	55	0	0	0	0
VI	60	0	0	0	0
VII	67	4	131.76 129.67 119.47 112.52	0	0
VIII	60	0	0	0	0
IX	0	0	0	0	0
X	0	0	0	0	0
XI	0	0	0	0	0
XII	0	0	0	0	0

Table 4

Number of determinations, exceedances and maximum recorded nitrogen dioxide in Satu-Mare city, in 2022

Sampling points/ month	No. of deter	Drum Carei	
		Exceeded Values µg/mc	Exceeded values µg/mc
I	62	-	-
II	60	-	-
III	69	-	-
IV	58	-	-
V	62	-	-
VI	62	-	-
VII	63	-	-
VIII	65	-	-
IX	64	-	-
X	65	-	-
XI	64	2	138.7 134.44
XII	49	-	-

During 2022, out of 743 determinations, 2 exceeded of the maximum permissible concentration were observed. These exceeded were recorded at the sampling point in Drum Carei in November of 138.70 µm/mc and 134.44 µm/mc (see table 4).

CONCLUSIONS

During the analyzed period (2018 - 2022), the analysis of the average of the four sampling points shows that the maximum permissible concentration of 100 µm/mc was not exceeded.

From the observations made at each sampling point, it results that in 2018 at the sampling point on Magnoliei Street in December were recorded 3 exceeded, the highest is 171.47 µm / mc. In 2019, most exceeded were recorded at the sampling points in Magnoliei Street and Şoimoşeni Street, 4 exceeded and 8 exceeded respectively.

During 2020, exceeded were also recorded at the points of Str. Magnoliei (4 exceeded) and Str. Şoimoşeni (10 exceeded).

From the analysis of the evolution of the nitrogen dioxide pollution level for 2022, 2 exceeded were determined at Drumul Carei in November.

The analysis of the five years (2018 - 2022) shows that a total of 33 exceeded were recorded. These exceeded were also for short periods at sampling stations in the city's industrial areas.

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