THE LEVEL OF AIR POLLUTION WITH NITROGEN DIOXIDE IN THE CITY OF SATU-MARE IN 2014-2015

Köteles Nandor*, Domuţa Cornel*, Pereş Ana Cornelia*

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048, Oradea, Romania, e-mail: kotelesnandor@yahoo.com

Abstract

This paper presents the study conducted on the level of air pollution with nitrogen dioxide in the city of Satu Mare in 2014-2015. The degree of air pollution with nitrogen dioxide is monitored by the Satu Mare Environmental Protection Agency (APM Satu Mare) in its four sampling points located in different parts of Satu Mare. A sampling point is in the central area of the city, at the venue of the APM Satu Mare, the next one is in the industrial area found in the north of the city (Şoimoşeni St). The third sampling point is located in the industrial area around Magnoliei St, while the fourth one at the junction of Burdea St and Careiului Rd.

The data on the degree of air pollution were obtained from the four sampling points. The evolution of the average concentrations of nitrogen dioxide at the four sampling points shows that the maximum permissible concentration, 100 µg/m^3, was not exceeded.

Key words: maximum permissible concentration, monitoring, nitrogen dioxide, sampling points

INTRODUCTION

The main pollution with nitrogen dioxide is caused by fuel burnt in engines, furnaces etc., which can lead to the formation of oxidant smog.

Studies conducted on this issue have shown that approximately 59% of the nitrogen dioxide emissions come from means of transport (Gavrilescu, 2008). The level of pollution with nitrogen dioxide has been studied by several researchers, including Măhăra (1976), Moza (2009), Pereş (2011), Köteles (2011).

MATERIAL AND METHOD

The data used in this study on the air pollution with nitrogen dioxide were provided by APM Satu Mare.

The monitoring of the degree of air pollution with nitrogen dioxide is done in four sampling points: the central area, where the venue of APM Satu Mare is, the junction of Burdea St and Careiului Rd, the industrial area around Magnoliei St and the industrial area in the north of Satu Mare, in Şoimoşeni St (http://apmsm.anpm.ro).

RESULTS AND DISCUSSION

1. Annual evolution of nitrogen dioxide concentrations

Looking at the measurements of the level of pollution with nitrogen dioxide, it can be seen that in 2015 and 2014 the highest concentrations were recorded at the Careiului Rd sampling point, 72.288 µg/m^3 and 71.778 µg/m^3 respectively, values which did not exceed the highest permissible concentration, which is 100 µg/m^3.

Higher concentrations were also recorded at the Magnoliei St sampling point, of 67.112 µg/m^3 in 2015 and of 64.713 µg/m^3 in 2014.

The readings at the other sampling points (the venue of APM Satu-Mare and Şoimoşeni St) over the two years of the study ranged from 25.324 to 45.73 µg/m^3 (Fig. 1).

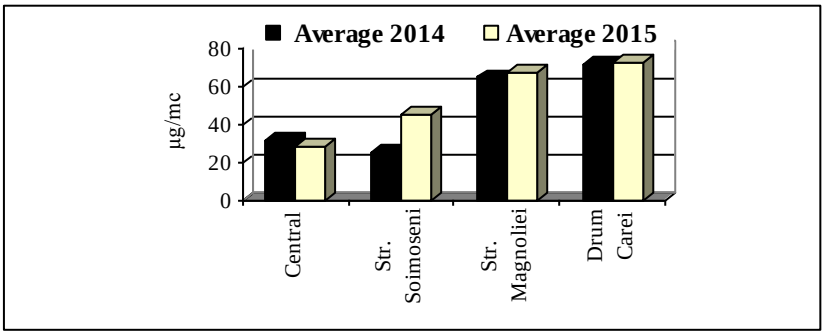

Fig. 1. Evolution of average concentrations of nitrogen dioxide in Satu Mare in 2014-2015

The average values for the two years of the study (2014-2015) show that the highest concentration of nitrogen dioxide occurred at the Careiului Rd sampling point, 72.033 µg/m^3, a value close to this one was obtained at the sampling point in Magnoliei St, 65.913 µg/m^3.

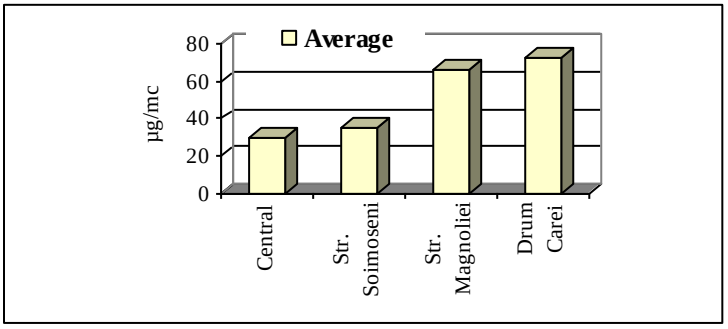

Fig. 2. Evolution of multiannual average concentrations of nitrogen dioxide at the 4 sampling points in Satu Mare in 2014-2015

The lowest values were recorded at the sampling point in the centre of the city (the venue of APM Satu-Mare), 30.162 µg/m^3, followed by the sampling point in Şoimoşeni St, 35.527 µg/m^3 (Fig. 2).

2. Monthly evolution of nitrogen dioxide

Looking at the monthly evolution of nitrogen dioxide concentrations in the years of the study (2014-2015), it can be seen that in 2015 the highest average concentration of the four sampling points taken together occurred in March (73.24 µg/m^3), followed by December (64.84 µg/m^3), then, January (64.438 µg/m^3) and April (61.113 µg/m^3). In 2014, the highest values occurred in May, 59.065 µg/m^3 and February, 56.938 µg/m^3.

The lowest values were recorded in September 2015, 31.13 µg/m^3, followed by August and October in 2014, 35.448 µg/m^3 and 38.77 µg/m^3 respectively (Fig. 3).

From the results obtained for the four sampling points it can be concluded that the limits of the maximum permissible concentration, 100 µg/m^3, were not reached.

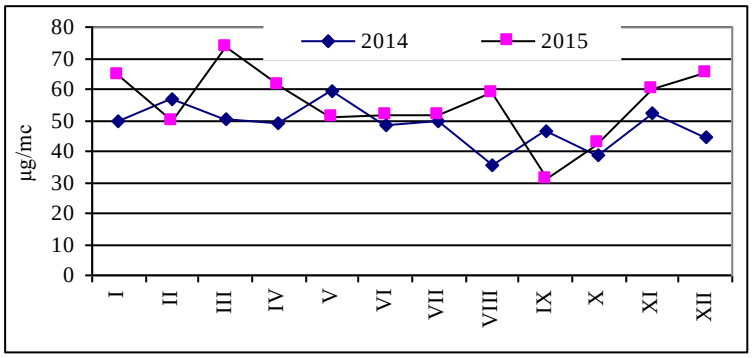

Fig. 3. Monthly evolution of the nitrogen dioxide at the 4 sampling points in Satu Mare in 2014-2015

Looking at the monthly averages of the four sampling points over the two years of the study, it can be seen that the highest level of pollution with nitrogen dioxide occurred in March, 50.538 µg/m^3. Values close to this one were recorded in April (48.91 µg/m^3), May (47.703 µg/m^3) and November (45.039 µg/m^3).

The lowest concentration of nitrogen dioxide was recorded in August 32.094 µg/m^3 (Fig. 4).

The daily readings of the pollution with nitrogen dioxide over the two years of the study show that of the 924 measurements taken in 2014 there were 42 times when the maximum permissible concentration (100 µg/m^3 - STAS 12574-87) was exceeded at three of the four sampling points (the

venue of the APM Satu-Mare in the centre of the city, Careiului Rd area, Magnoliei St).

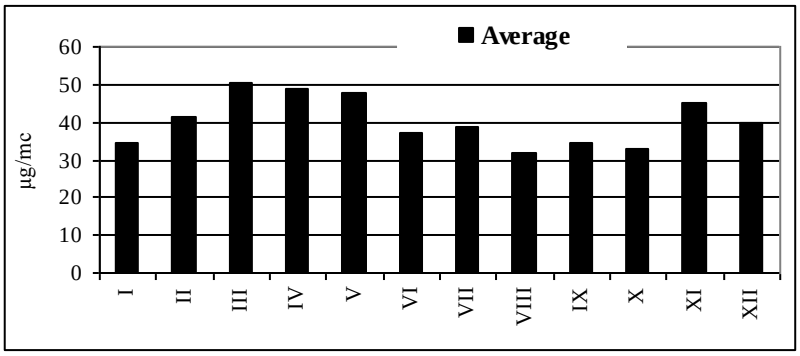

Fig. 4. Averages of nitrogen dioxide monthly concentrations at the four sampling points in Satu Mare over 2014-2015

At the Şoimoşeni St sampling point the maximum permissible concentration was never exceeded, while at the sampling point in the centre of the city there was one occasion when that happened, in February, 113.16 µg/m^3. At the sampling point in Magnoliei St there were 10 times when the readings were above the maximum allowed value, the highest reading being 131.85 µg/m^3, at the Careiului Rd sampling point there were 31 excesses and the highest recorded value was 184.54 µg/m^3 (Tab. 1).

Table 1

Number of readings, excesses and the highest level of nitrogen dioxide recorded in Satu Mare in 2014

Samplig points/ months	Centre of the city			Şoimoşeni St			Magnoliei St			Careiului Rd		
	No. of read-ings	No. of ex-cesses	Highest rec. value µg/m^3	No. of read-ings	No. of ex-cesses	Highest rec. value µg/m^3	No. of read-ings	No. of ex-cesses	Highest rec. value µg/m^3	No. of read-ings	No. of ex-cesses	Highest rec. value µg/m^3
I	79	-	-	79	-	-	79	-	-	79	2	108.56
II	76	1	113.16	76	-	-	76	-	-	76	1	100.91
III	76	-	-	76	-	-	76	1	114.08	76	3	180.25
IV	77	-	-	77	-	-	77	2	131.85	77	5	184.54
V	73	-	-	73	-	-	73	4	118.06	73	7	158.19
VI	78	-	-	78	-	-	78	1	107.95	78	1	136.76
VII	86	-	-	86	-	-	86	-	-	86	3	132.46
VIII	76	-	-	76	-	-	76	1	118.67	76	-	-
IX	84	-	-	84	-	-	84	-	-	84	2	129.39
X	85	-	-	85	-	-	85	-	-	85	-	-
XI	61	-	-	61	-	-	61	-	-	61	7	170.76
XII	73	-	-	73	-	-	73	1	102.12	73	-	-

In the year 2015, 856 measurements were taken and there were 39 times when the maximum permissible concentration was exceeded. At the

sampling point in the centre of the city the allowed value was not exceeded. At the sampling point in Şoimoşeni St there was one occasion when the value went beyond what was allowed, 119.59 μg/m^3, while at the sampling point in Magnoliei St the maximum permissible concentration was exceeded 14 times, the highest recorded value being 188.52 μg/m^3. At the sampling point in Careiului Rd the maximum permissible concentration was exceeded 24 times, the highest recorded value being 191.90 μg/m^3 (Tab. 2).

Table 2

Number of readings, excesses and the highest level of nitrogen dioxide recorded in Satu Mare in 2015

Samplig points/ months	Centre of the city			Şoimoşeni St			Magnoliei St			Careiului Rd		
	No. of read-ings	No. of ex-cesses	Highest rec. value μg/m^3	No. of read-ings	No. of ex-cesses	Highest rec. value μg/m^3	No. of read-ings	No. of ex-cesses	Highest rec. value μg/m^3	No. of read-ings	No. of ex-cesses	Highest rec. value μg/m^3
I	79	-	-	79	-	-	79	8	188.52	79		
II	53	-	-	53	-	-	53	2	129.09	53		
III	54	-	-	54	-	-	54	3	159.99	54	4	159.99
IV	45	-	-	45	-	-	45			45	1	138.28
V	74	-	-	74	-	-	74			74	1	126.94
VI	78	-	-	78	1	119.59	78	1	118.67	78	4	138.58
VII	80	-	-	80	-	-	80			80	3	121.74
VIII	73	-	-	73	-	-	73			73	3	191.90
IX	84	-	-	84	-	-	84			84		
X	82	-	-	82	-	-	82			82		
XI	75	-	-	75	-	-	75			75	2	123.57
XII	79	-	-	79	-	-	79			79	6	145.02

CONCLUSIONS

The averages of nitrogen dioxide concentrations over the two years of the study at the four sampling points show that the maximum permissible concentration, 100 μg/m^3, was not exceeded. The highest concentrations were recorded at the Careiului Rd sampling point, the values of 72.288 μg/m^3 and 71.778 μg/m^3, in 2015 and 2014 respectively. This sampling point is located in a place with heavy traffic (the junction of Burdea St and Careiului Rd).

The monthly evolution of pollution level with nitrogen dioxide over the two years of the study shows that the averages of the four sampling points in 2015 reached the highest value in March (73.24 μg/m^3), and the lowest in September, 31.13 μg/m^3. In 2014, the highest concentration of nitrogen dioxide was reached in May (59.065 μg/m^3), and the lowest in August (35.448 μg/m^3).

REFERENCES

1. Ciulache S., 2004, Influenţa condiţiilor meteorologice şi climatice asupra poluării aerului. Com. Geogr. V, Ed. Univ. Bucureşti
2. Domuţa C., Brejea R., 2010, Monitoringul mediului. Ed. Universităţii din Oradea
3. Dumiter A.F., 2005, La pollution et la protection de l'atmosphere dans la ville d'Oradea. Analele Universităţii din Oradea, Seria Geografie, Tom.XV, pp.157-164
4. Gavrilescu E., 2008, Surse de poluare şi agenţi poluanţi ai mediului. Ed. Sitech, Craiova
5. Köteles N., 2011, Noţiuni practice şi teoretice de poluare şi depoluare a aerului atmospheric. Ed. Universităţii din Oradea
6. Köteles N., Pereş A.C., 2010, Air Pollution with Powders in Suspension (PM_{10} and $PM_{2,5}$) in Oradea City Area. Analele Universităţii din Oradea, Fascicula Protecţia Mediului, Vol. XV, Anul 15, Ed. Universităţii din Oradea, 2010, ISSN 1224-6255, pp.657-660
7. Măhăra Gh., 1976, Poluarea aerului şi a apelor din spaţiul Câmpiei Crişurilor şi a zonelor limitrofe. Buletinul Societăţii de Ştiinţe Geografice din RSR, Seria IX, Vol. IV (LXXIV), Bucureşti, pp.170-177
8. Mănescu S., Cucu M., Diaconescu M., 1994, Chimia sanitară a mediului. Ed. Medicală, Bucureşti
9. Moza A.C., 2009, Clima şi poluarea aerului în bazinul hidrografic Crişul Repede. Ed. Universităţii din Oradea
10. Moza A.C., Köteles N., 2010, Pollution with Sedimentary Powders in Crişul Repede Drainage Area. Research Journal of Agricultural Science Timişoara, Vol. 42 (3), 2010, ISSN: 2066-1843, pp.718-722
11. Pereş A.C., 2011, Poluarea şi autopurificarea atmosferei. Ed. Universităţii din Oradea
12. Pereş A.C., Köteles N., 2010, Aspects on Air Pollution with Nitrogen Dioxide in the City Area Oradea. Analele Universităţii din Oradea, Fascicula Protecţia Mediului, Vol. XV, Anul 15, Ed. Universităţii din Oradea, 2010, ISSN 1224-6255, pp.735-739
13. Pereş A.C., Köteles N., Pârloiu C., 2011, The Level of Air Pollution with Depositing Dust in Bihor County. Analele Universităţii din Oradea, Fascicula Protecţia Mediului, Vol. XVII, Anul 16, Ed. Universităţii din Oradea, 2011, ISSN 1224-6255, pp.793-800
14. ***, 1987, STAS 12574-87
15. ***, 2002, Normativ din 25 iunie 2002, privind stabilirea valorilor limită, a valorilor de prag şi a criteriilor şi metodelor de evaluare a dioxidului de sulf, dioxidului de azot şi a oxizilor de azot, pulberilor în suspensie (PM_{10} şi $PM_{2,5}$), plumbului, benzenului, monoxidului de carbon şi ozonului în aerul înconjurător. Ministerul Apelor şi Protecţiei Mediului, Bucureşti
16. http://apmsm.anpm.ro/