

STUDY ON AIR POLLUTION IN THE CITY OF ORADEA AND ITS METROPOLITAN AREA

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Abstract

Air pollution is one of the current problems facing the social and economic environment; given the influence that this phenomenon has on health. The study follows the annual average values of emissions for NO₂, SO₂ and CO in Oradea city and its metropolitan area. The recorded values did not exceed the maximum rate allowed, hovering even below the national average.

Keywords: pollutants, values, health

INTRODUCTION

Air pollution represents contamination of the indoor and outdoor environment by different chemical, physical or biological agent that causes modifications of the natural characteristics of the atmosphere. By the way of action, pollutants are classified as: irritating pollutants, asphyxiating pollutants, carcinogens, allergenic, fibrosis, systemic and biological. Air pollution harms human health, particularly in those already vulnerable because of their age or existing health problems. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide (<http://www.who.int/topics>).

The aim of this study was to investigate and monitor air pollution with NO₂, SO₂ and CO in the city of Oradea and in the metropolitan area, quantifying, at the same time, its effect on health.

MATERIAL AND METHODS

Air quality monitoring in Bihor County is achieved by a monitoring network consisting of: automatic stations monitoring air quality, particulate sediment sampling points and precipitation sampling points.

Automatic stations provide real-time data. The data is stored on the central server located at the APM Bihor; then, they will be validated and certified under RNMCA (National Network for Air Quality Monitoring).

Currently, automatic network monitoring air quality in Oradea, took and processed data from the 4 monitoring stations (located under the provisions of Ministerial Order no.592/2002). These 4 stations are located as follows:

1. BH1 station (station urban-FU) - located in the inner courtyard of APM Bihor, Dacia Blvd # 25 / A, which monitors on-line the following pollutants: CO, SO₂, NO, NO₂, NO_x, O₃, PM₁₀ (particulate matter), BTX (benzene, toluene, xylene), meteorological parameters;

2. BH2 Station (industrial state-SI) - located in the courtyard of the Episcopia Bihor Secondary School, Str. Matei Corvin No. 106/A, with the following parameters monitored: CO, SO₂, NO, NO₂, NO_x, O₃, PM₁₀ (particulate matter), meteorological parameters;

3. BH3 Station (Station Traffic-ST) - Set in Nufărul Blvd., on-line monitoring the following pollutants: CO, SO₂, NO, NO₂, NO_x, O₃, PM₁₀ (particulate matter), BTX (benzene, toluene, xylene), meteorological parameters.

4. BH4 Station (industrial state-SI) - located in Țețchea, that monitors on-line following pollutants: CO, SO₂, NO, NO₂, NO_x, PM₁₀ (particulate matter with diameter less than 10 microns).

The data presented in this study reflect the situation of air pollutants in 2010/2011, being provident by APM Bihor and the World Health Organization; and they were processed involving a descriptive and comparative study.

RESULTS AND DISCUSSIONS

Nitrogen oxides (NO and NO₂). NO₂ is a reddish-brown gas with a sharp odor. The primary source of this gas is vehicle traffic, and it plays a role in the formation of tropospheric ozone. Large concentrations can reduce visibility and increase the risk of acute and chronic respiratory disease. (Daly, A. and P. Zannetti, 2007.).

The value of NO₂ pollution in Oradea is presented in table 1.

Table 1.

Summary of NO₂ pollution in Oradea

Station	Nitrogen dioxide (NO ₂) - μg/m ³			
	Minimum concentration	Maximum concentration	Annual average value	Maximum limit (Order 592/2002)
BH1	14,44	28,50	21,54	40
BH2	6,36	17,23	10,71	40
BH3	22,77	26,14	24,87	40
BH4	4,91	13,45	9,19	40

In the city of Oradea, the major NO₂ emissions are recorded in the autumn-winter months.

Sulfur dioxide (SO₂). This compound is colorless, but has a suffocating, pungent odor. The primary source of SO₂ is the combustion of sulfur-containing fuels (e.g., oil and coal). Exposure to SO₂ can cause the

irritation of lung tissues and can damage health and materials. (Daly, A. and P. Zannetti, 2007)

The value of SO₂ pollution in Oradea is presented in table 2.

Table 2.

Station	Sulfur dioxide (SO ₂) - μg/m ³			
	Minimum concentration	Maximum concentration	Avaradge value	Maximum limit (Order 592/2002)
BH1	2,17	6,76	4,06	20
BH2	2,26	11,85	5,52	20
BH3	2,18	3,84	3,01	20
BH4	3,31	12,34	6,90	20

The highest values were recorded at station BH2 in the spring (March-May).

Recorded values for NO₂ and SO₂ emissions at Oradea are below the national average.

Compared with other neighboring countries, EU members, Romania exceeds SO₂ emissions, but the values for emissions of NO₂ are below the average annual in other countries (table 3 and fig.1).

Table 3.

Average annual concentration of SO₂ and NO₂emissions, (μg/m³)
(<http://data.euro.who.int>)

Country	SO ₂		NO ₂	
	2010	2011	2010	2011
Romania	15	10,8	20,1	20,5
Bulgaria	9,4	12	31,3	33,3
Hungary	6,7	7,1	28,1	28,4



Fig. 1. Comparison of average annual concentration of SO₂ and NO₂ (μg/m³) in Europe (WHO/Europe, European HFA Database, July 2013)

Carbon monoxide (CO). This odorless, colorless gas is formed from the incomplete combustion of fuels. Thus, the largest source of CO today is motor vehicles. Inhalation of CO reduces the amount of oxygen in the bloodstream, and high concentrations can lead to headaches, dizziness, unconsciousness, and death. (Daly, A. and P. Zannetti, 2007).

Validated average values of carbon monoxide presented following oscillations at the 4 monitoring stations:

Table 4.

Station	Carbon monoxide (CO) - $\mu\text{g}/\text{m}^3$		
	Minimum concentration	Maximum concentration	Annual average value
BH1	0,06	1.02	0,36
BH2	0,07	0.89	0,42
BH3	0,09	0,57	0,22
BH4	0	0	0

CONCLUSIONS

In 2010, there were no exceedances of the limit values for none of the indicators followed by the monitoring stations regarding human health protection.

Recorded values are below the national average and they are comparable to other values of EU countries.

In terms of emissions of NO₂, SO₂ and CO, Oradea and its metropolitan area can be considered less polluting and they do not endanger residents' health.

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