ASPECTS REGARDING AIR QUALITY IN DEVA AREA

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ABSTRACT. **Aspects regarding air quality in Deva area**. The attenuation of air quality in the urban environment is determined by artificial warming, a result of the radiation emitted by constructions, economic activities, as well as the climatic elements characteristics. In the survey regarding air quality in Deva we will analyse the concentrations of NO_2, O_3, SO_2 and their implications on air quality.

Keywords: pollution, Deva area, air quality.

1. INTRODUCTION

The hereby survey highlights the relation between the pollution sources and air quality, the way in which the presence of pollutants in the atmosphere determines modifications in the air composition. The atmospheric pollutants determine the air quality in Deva area by their composition, concentration and the climactic elements report.

The main pollution sources in Deva area having an impact on air quality are: industry (thermal and electrical power producers, construction materials and food and light industry manufacturers), agriculture, transports and other sources. The dissipation of pollutants in the atmosphere is made under different forms according to the pollution source and the type of pollutant.

In the hereby survey we will analyse the NO_2, O_3, SO_2 concentrations and their implications on the air quality in Deva area.

2. THE ANALYSIS OF AIR QUALITY BASED ON THE NO_2, O_3, SO_2 CONCENTRATIONS

The presence of polluting substances in the atmosphere affects the environment in general and the population's health in particular.

Within Deva area, permanent measurements of atmospheric noxae are made in two fixed points. In order to make the measurements, automatic stations are placed in points considered characteristic for determining the air pollutants concentrations: on Carpați street – HD1 – urban station and Calea Zarandului – HD2 – industrial station.

The nitrogen dioxide (NO_2) is formed as a result of the activities regarding road transports, being part of exhaust gases composition. The nitrogen dioxide pollution is determined by the circulation of vehicles, energetics industry, home activities and the incineration of industrial waste product. In Deva area, the most

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important polluting source is the Mintia-Deva Power Station, which produces electric and thermal power with coals, black oil and marsh gas.

Table. 1. ***The average monthly values for NO_2, at the HD2 Calea Zarandului industrial station, (2008-2010)***

NO_2 Calea Zarandului mg/m^3	Jan.	Feb	Mart.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Med.
2008	0,024	0,025	0,034	0,029	0,022	0,019	0,023	0,025	0,022	0,027	0,031	0,024	0,025
2009	0,025	0,025	0,024	0,022	0,020	0,018	0,015	0,015	0,023	0,023	0,014	0,014	0,019
2010	0,012	0,013	0,015	0,011	0,009	0,007	0,008	0,009	0,010	0,012	0,017	0,015	0,011

(Source: APM Hunedoara)

The data provided by the automatic station HD2 - industrial station – Calea Zarandului highlights, over the 2008-2010 period, the reduction of average monthly amount of NO_2 in 2010 compared to 2008 (table no. 1). This is located on the outskirts of Deva, on an intensely circulated artery on an area where solid fuels are used (coal and wood) to heat homes. Analysing the maximum values of NO_2 at this industrial station, it is ascertained that the values of CMA (0.100 mg/m^3) were not exceeded, and the average values decreased from 0.025 mg/m^3 in 2008 to 0.081 mg/m^3 in 2010 (fig. 1).

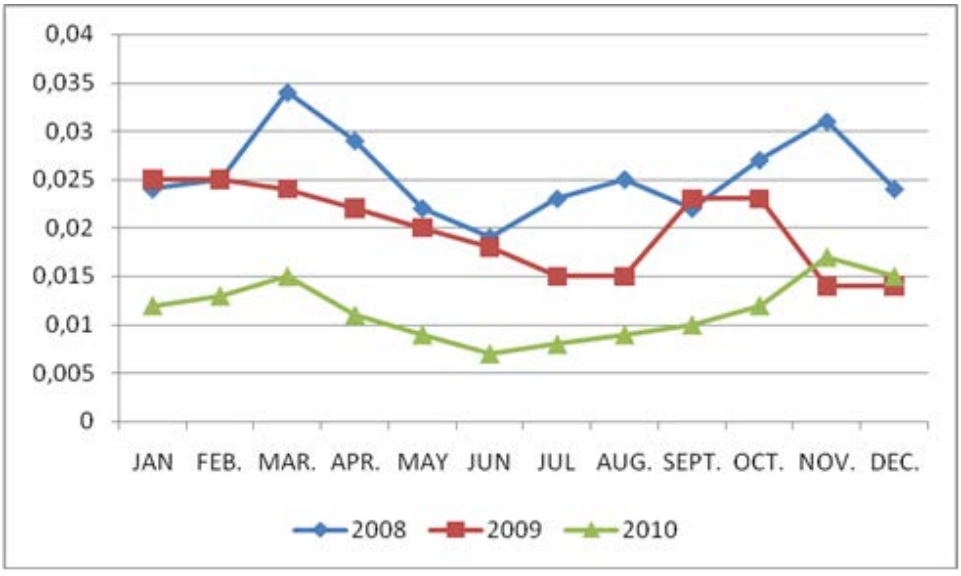

Fig. 1. ***The average monthly values of NO_2 (mg/m^3), at HD2 Calea Zarandului (2008-2010) (Source: APM Hunedoara)***

The high values of NO_2 in the cold seasons are determined by the fact that the air temperature is low, which favours the persistence a large amount of pollutants in the atmosphere. Analysing the monthly evolution of NO_2 amount in

the atmosphere, we can estimate it has an inversely proportional course to the one of air temperature (table no. 2 fig. 2).

Table 2. ***The average monthly values for NO_2, at HD2 Calea Zarandului station compared to those of the average monthly temperature (2010)***

Luna	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.
HD_2 2010 (mg/m^3)	0.012	0.013	0.015	0.011	0.009	0.007	0.008	0.009	0.01	0.012	0.017	0.015
Average Temp. (°C)	-1.0	2.3	5.6	11.1	15.4	19.5	21.3	21.4	15.1	7.9	7.6	-0.6

(Source: APM Hunedoara)

The decreasing of the average monthly values of NO_2 is determined by the modernisation of the steam power plant by equipping it with filters, but also reducing the activity at the Mintia-Deva Power Station.

Under the influence of natural light, NO2 decomposes and produces the atomic oxygen, which combines with molecular oxygen and produces the ozone, the first component of the oxidizing smog. In the absence of hydrocarbons, these reactions come to a balance, thus giving a relatively low concentration of ozone. By including unsaturated hydrocarbons in this chain of reactions, beside ozone, there will be produces the second main photochemical oxidizer – peroxyacetylnitrate colloquially named PAN or peroxide nitrate of acetic acid (CH3COONO2), as well as other photochemical oxidizers similar to these.

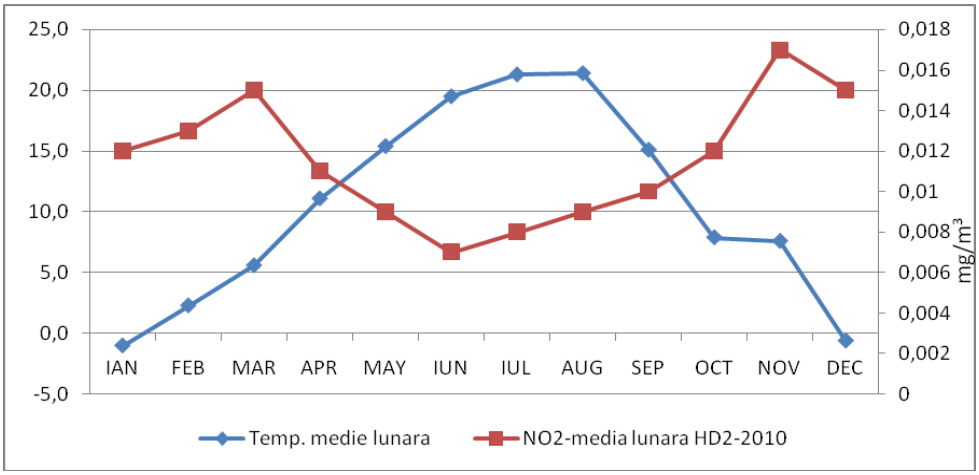

Fig. 2 ***The variation of the average amount of NO_2 in relation with air temperature as HD2 – Calea Zarandului (Source: APM Hunedoara)***

The ozone becomes pollutant agent when it exceeds a certain concentration in the inferior layers of the atmosphere and, together with PAN, produces irritation

to the eyes (Gh. Măhăra, 2001). At Deva, such combinations of gases in the atmosphere can happen due to the pollution sources.

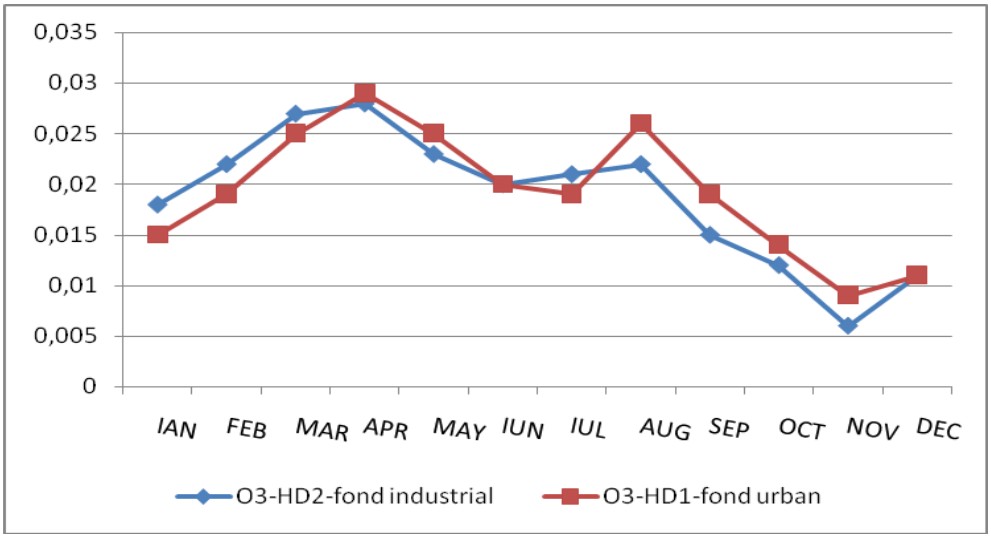

Fig. 3 ***The variation of the average amount of O_3 at the urban station HD1 and the industrial station HD2 (Source: APM Hunedoara)***

Comparatively analyzing the O_3 level in the inferior atmosphere, indicated at the two automatic stations, certain characteristics of the concentrations can be noticed according to the season and local characteristics of the points where the measures have been made.

Dowtown Deva (HD1 – urban station), the concentration of O_3 is higher during the warm seasons than at HD2 – industrial station (Fig. 3), situation determined by the existence of the heat island in the centre of the city in comparison with the city peripherical area, where Mureș couloir favours an active dynamic of the air masses.

The sulphur dioxide (SO_2) is the result of burning the fuels in steam power plant, in the homes, but also a result of the road traffic. The most of the sulphur dioxide in the air comes from the steam power plants and aproximately 5% is owed to the exhaust gas emission ejected by vehicles.

When the humidity is high, the sulphur dioxide in the atmosphere causes acid rains, the water vapours having a chemical reaction with the sulphur dioxide, thus resulting the sulphur acid H_2SO_4. This produces troubles of breathing appliance in the human body.

In Hunedoara country, the major source of SO_2 emissions is represented by the thermal power station – SC Mintia-Deva, which is part of the National Program of Progressively Reducing the Emissions, specified in conformity to the requirements HG (Government Decision) 5541/2003, for the SO_2 emissions until the end of 2013.

Analysing the chart of the SO_2 evolution concentration over the 2003-2010 period of time, it is observed that, starting with 2003, these emissions present a continuous decrease (Fig. 4), tendency mainly caused by the decrease of industrial activity in the whole county.

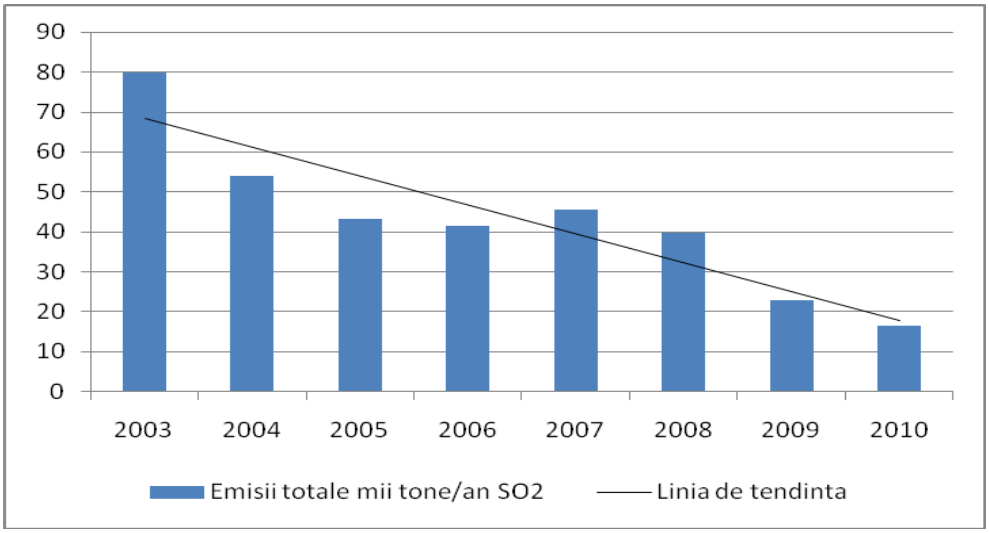

Fig. 4 ***The evolution of annual emissions of sulphur dioxide (tones/ year) and their evolution tendency (Source: APM Hunedoara)***

The analysis of the SO_2 concentration in Deva area highlights the pollutant concentration in the two points of measurements, with different values, mostly due to their placements (HD1 – urban station and HD2 – industrial station).

Table 3. ***The monthly average values of SO_2 in the observation point HD2 – industrial station in the year of 2010 in Deva***

SO2-HD2 Calea Zarandului (mg/m^3)	Ian.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept	Oct.	Nov.	dec	Med
2008	0,0018	0,0017	0,0013	0,0010	0,0021	0,0026	0,0030	0,0027	0,0013	0,0016	0,0009	0,0013	0,0017
2009	0,0014	0,0010	0,0017	0,0009	0,0019	0,002	0,0018	0,0014	0,0021	0,0017	0,0011	0,0010	0,0015
2010	0,0011	0,0010	0,0015	0,0012	0,0013	0,003	0,0013	0,0015	0,0018	0,0013	0,0014	0,0007	0,0012

(Source: APM Hunedoara)

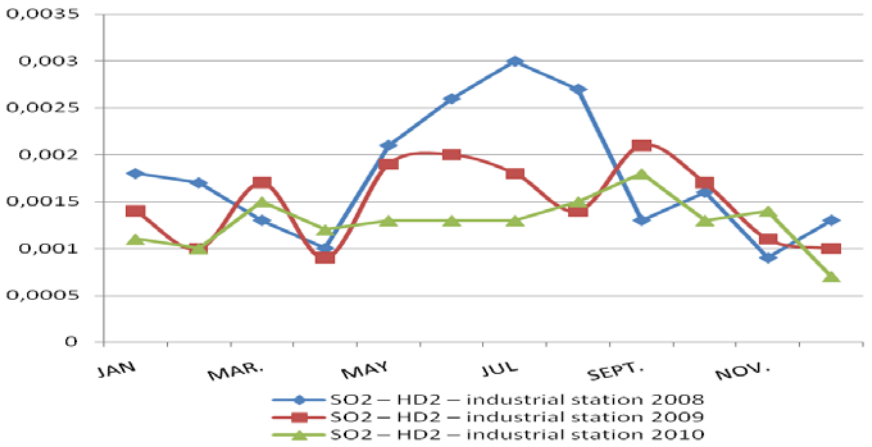

Fig. 5 ***The monthly average values of SO_2 (mg/m^3) at HD2 – Calea Zarandului (2008-2010)***
(Source: APM Hunedoara)

Over the analysed period of time, the highest monthly value of the SO_2 concentration at the automatic industrial station HD2 was registered in 2008 July (0.0017 mg/m^3) and the lowest in 2010 December (0.0012 mg/m^3) (Table no. 3 and Fig. 5). The decrease of SO_2 concentration for the surveyed period pf time was determined by the reduction of the main pollutants activity as well as by the installation of special filters at the polluting sources.

The total amount of SO_2 for 2010 at the sampling site at the industrial statino HD2 on Calea Zarandului was 0.059 mg/m^3.

The capacity of the atmophere for dispersing pollutants is conditioned by physical parametres which define the dynamic and thermal status of atmospheric air: the wind system and vertical thermal gradient, vertical convective currents, atmospheric turbulence and thermal startification in the inferior layer of the atmosphere. Wind speed has a great importance in the process of pollutants diffusion (Fărcaș, 1999).

Urban pollution is emphasised by the presence of urban breeze which is formed in a stable atmosphere with clear sky. The urban breeze conducts the pollutants to the central parts of the city, where these are elevated by ascending movements. At the top, there is a contrary breeze named anti-breeze. Under these circumstances, pollution domes are formed over the city, which can reach 200-300 metres in the afternoon hours, when the thermal convection is more intense. Over the night, the pollutants descend because of air cooling on the vertical. In the meantime, in the surroundings, the pollutants stay on the ground due to the persistence of thermal inversions. The breeze type circulation is maintained over the night only above the city area, being caused by the heat emitted by the asphalt and buildings heated over the day. This will cause a continuous flow of pollutants in narrow faction toward the centre of the city (W. Bach, 1970, quoted by Fărcaș, 1999).

3. CONCLUSIONS

The monthly evolution of NO_2 amount in the atmosphere has an inversely proportional course to that of air temperature.

At the urban stationi HD1, the concentration of O_3 is higher in the warm season than the one established at the industrial station HD2.

The highest monthly value of SO_2 concentration at the automatic industrial station HD2 was recorded in July, 2008: 0.0017 mg/m^3 and the lowest value for the time surveyed was registered in December, 2010, reaching 0.0012 mg/m^3. The decreasing of SO_2 concentration was determined by the activity reduction of the main pollutants as well as by the installations modernization with special filters of pollution sources.

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