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The Impact of Air Pollution in Agglomerations in the City of Alba Iula

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Abstract: Air pollution during this period is a major challenge, mainly due to the upward action of pollutants on the environment in general, on human health, in other words their impact on air, water, soil and biodiversity. Adapting and applying solutions to reduce air pollution is possible only through intensive research - innovation, which is supported by all decision-makers who have the financial resources. Air pollution and its impact on human health, ecosystems and biodiversity must be further reduced, and the long-term goal is not to exceed critical quantities and levels. To this end, efforts must be stepped up to fully comply with EU air quality legislation. The main indicators of urban pollution are directly related to the territorial size of the urban center, as well as to infrastructure, population density, industrial development and the location of the company, through their manufacturing process. The main causes of pollution in the urban center are: the explosive growth of the population together with the massive migration from rural to urban areas.
In the content of the article, reference is made to the crowded areas of the city of Alba Iulia - Romania, areas where the results obtained from the measurement of PM10, PM2.5 particles
they are presented in detail on the basis of tables and graphical representations with the help of high-performance measuring and determining equipment. The measured values will be analyzed and compared, formulating some conclusions and concrete directions to reduce their level
Keywords: pollution, fine particles, urban mobility, car traffic, environment

I. INTRODUCTION

The organization of the economic and social life of human communities has been, is and will be inextricably linked to their mobility, to the possibility of their members to use the car to move in order to meet the needs of supply, food, work, recreation.. This aspect is due to the numerous sources of anthropogenic pollution degenerated by the urbanization effect. A significant example of this is the level of pollution due to road traffic. In congested areas, the population has to deal with a major problem related to air quality degradation Pollution negatively affects the environment and human health, in this sense, the inhabitants of Alba Iulia are among those targeted, facing serious risks to their health. These risks are mainly due to environmental pollution, caused by particulate matter PM10, PM2.5 and ozone (O3), followed by nitrogen dioxide (NO2) and carbon dioxide (CO2).

The development of neighborhoods, cities and regions in such a way as to have as little dependence on the personal car as possible has shown that they produce sustainable urban forms with a healthier environment, less pollution that offers a variety of transportation options.. Throughout the territory, but also in the immediate vicinity of the city of Alba Iulia, there are numerous sources of air pollution that negatively influence air quality and cause problems that can not be neglected in terms of quality of life of its inhabitants.

Today, air pollution is a global and complex process that has been going on for a very long time, and as a result of the level of pollution and under the influence of non-governmental organizations there have been strong motivations for reducing air pollution and harmonizing national and international environmental norms. improving interstate relations in this area. It follows that it is necessary to give greater importance to solutions and methods of reorganizing urban car traffic, which will reduce air pollution and will certainly have significant effects on the social and economic life of each locality.The objectives pursued are described as follows:

- Evaluation of the level of fine particles PM 10 and PM 2.5 in the agglomerated areas of Alba Iulia municipality
- Assessment of the level of pollution in restricted areas (hospitals, schools, kindergartens, agri-food markets);
- Proposing concrete methods to reduce the level of pollution due to these pollutants caused by wind speed.

We bring to your attention alternatives to the use of the vehicle in order to reduce pollution in the busiest areas of Alba Iulia. In this sense, the Smart City project is underway, a system for renting electric bicycles and

electric bicycles, with wireless charging of their batteries, software and data transmission in the cloud system, etc

II. Methodology

Fine particulate pollution is currently one of the most discussed and studied environmental quality issues. Fine particles generated by car exhaust pipes, industrial pollution, chemical reactions of sulfur and nitrogen oxides have a strong undesirable effect on human health, especially fine material particles of the order of micrometers. Particles suspended from the atmosphere are pollutants that are transported over long distances.

They can be caused by natural causes, such as wind entrainment of soil particles, volcanic eruptions, road transport, dumps and industrial dumps.

The current fixed air quality monitoring station is urban, assesses the influence of "human settlements" on air quality; the range is 1-5 km and the pollutants monitored are: sulfur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), ozone (O3), volatile organic compounds (VOCs) and dusts in suspension and weather parameters (wind direction and speed, pressure, temperature, solar radiation, relative humidity, precipitation). On the territory but also in the immediate vicinity of the city there are numerous sources of air pollution, which negatively influences air quality and causes problems not to be neglected in ensuring the quality of life of its inhabitants. he location of the air quality monitoring station in Alba Iulia, as an integral part of the National Air Quality Monitoring Network is presented in the table below:

When establishing the level of air pollution in Alba Iulia, the level of pollutants and pollution sources are taken into account, as well as meteorological data obtained in stations equipped with meteorological sensors, respectively wind direction and speed, temperature, pressure, humidity, precipitation and intensity of solar radiation. The values of suspended dust concentrations monitored by automatic measurements (nephelometric method) are indicative values, for quick information; the reference measurement method provided in Law 104/2011 on ambient air quality for this indicator is the gravimetric method. This consists in the collection on filters of the fractions PM10, respectively PM2,5, of the dusts suspended in the air and the determination of their mass by the method of weighing in the laboratory. PM10 refers to particles with an aerodynamic diameter of less than 10 µm, and PM2.5 particles refer to particles with an aerodynamic diameter of less than 2.5 µm.

The measurements performed by us were among the momentary (short) ones, which are in fact short-term samples (maximum 15-20 minutes) and whose average actually makes an estimate of the values valid for all the time necessary for verification. This procedure is generally applied to determine the high concentrations that occur during short-term technological operations or for routine measurements. For the analysis of particles in the atmosphere, it is important to remember that we must consider establishing the procedures that will be applied. Thus, the method of particle sampling, the equipment used, the particle size distribution, the particle composition must be determined from the outset

The measuring instrument used in the research was the Dust Trak Aerosol Monitor photometer, which is an analog measuring instrument (the output signal is a continuously variable size within the measurement range).

These DustTrak aerosol units are easy to program and operate, designed for a variety of different applications, including indoor air quality management and outdoor environmental monitoring.

The measuring instrument is digital, and has a number of advantages such as: high measuring speed, elimination of reading errors, high accuracy, lower sensitivity to disturbances and the possibility of using the computer for data processing. In the present research, the measurement method was direct, in real time.

Energy-efficient, long lasting external pump for continuous, unattended, 24/7, outdoor monitoring applications. Simultaneously measure size-segregated mass fraction concentrations corresponding to PM1, PM2.5, Respirable, PM10 and Total PM size fractions.

Benefits

- Simultaneously measure size-segregated mass fraction concentrations corresponding to PM1, PM2.5, Respirable, PM10 and Total PM size fractions
- Manual and programmable data logging functions
- Desktop unit
- Aerosol concentration range 0.001 to 150 mg/m3
- The photometer technique allows the continuous recording of the concentration of aerosols near the mouth throughout a breathing cycle. From such simultaneous recordings and measurements of respiratory volumes and aerosol flow rates on successive fractions of inhaled and exhaled air, the concentrations present in the air and in the immediate area of respiration may be assessed.

The advantages of the Dust Trak Aerosol Monitor tool are related to the fact that it provides real-time data, is portable, determines several fractions of material particles simultaneously (PM1, PM2.5, PM4, PM10 and TSP). It has memory that stores a considerable base of information on aerosol particle concentrations.

The Dust Trak DRX Analyzer - Model 8533 is a photometer with laser that offers real-time reading of mass concentrations of aerosols and fractions of their size.

The material particles are taken up by a suction pump and reach the optical chamber; the total aspirated flow is 3 l / min, of which l / min is passed through a HEPA filter to remove particles and used for the flow sheath; the 2 l / min, which represents the mass of the aerosol flux, which reaches the optical chamber, where a laser light flux (with a wavelength of 655 nm) reaches the particles. Diffuse light in the $90^{o} \pm 62$ ° scattering angle is captured by a layer of spherical mirrors and focused on a photodetector.

The total flow of 3 l / min is controlled by the feedback between the pump and the flow meter. The flow meter monitors the flow rate according to the manufacturing reference values, especially when collecting data. The nozzle has the role of classifying PM fractions.

The laser diode emits light that passes through a set of lenses taking place in optical focus; then the contact between the sample particles and the laser light takes place, scattering in all directions.

The photodetector converts light into a voltage that is made to determine aerosol mass concentrations (mg / m3). The photometer measures particle sizes from 0.1 microns to 10 microns, with concentrations ranging from 0.1 mg / m3 to 100 mg / m3 or more. The photo-detector signal is recorded and processed by the photometric voltage direct current (DC) by the particle analyzer.

III. Results and Discussion

We established the measurement areas based on the criteria of heavy traffic and on the criterion of the importance of air quality in certain more special areas, such as schools and hospitals, kindergartens. The measurement steps performed by us were performed in 2019 in two different periods in order to draw conclusions regarding the temperature and speed of air movement, weather conditions. As mentioned above, the measurement points were chosen around schools, markets, hospitals and kindergartens, because there are more vulnerable people. to pollution with the respective fine particles.

Thus, the following measurement areas were established:

A. Central area - The intersection of Tudor Vladimirescu and Calea Moţilor streets;

B. Economic College from T. Vladimirescu Street;

C. The area of the Alba-Iulia County Hospital from Revoluției Street 1989;

Several measurements were taken in each area to determine the values of PM10, PM2.5 as real as possible. The intensity of road traffic was also monitored by counting the number of vehicles. The following table shows the measurement points taking into account the impact of pollutants on the elderly, mostly with multiple diseases, on students of young children.

A.Table.1: Values measured at the intersection of T. Vladimirescu . with Calea Moţilor

number of points	the street	hour	PM2,5 µg/m^3	PM10 µg/m^3	COV mg/m^3	CO2 ppm	T ^{0}C	humidity %	number of vehicles
1	T Vladimirescu, near the Unirea store	10,0	74	97	6,3	612	21,5	56,1	76
2	Calea Moţilor, 50 m from the intersection	10,2	72	94	9,0	682	19,7	50,4	75
3	T Vladimirescu corner with Calea Moţilor	11.0	66	91	4,3	452	17,3	55,9	68
4	T. Vladimirescu at 50m from another intersection	11.2	65	75	3,0	452	17,4	57.7	66

	Average values		69,25	89,25	5,65	549,5	18,9	55,0	

After presenting in tabular form the measured values, we present below in graphical form these evolutions, including the average value for each measuring point, respectively each intersection. allowed values.

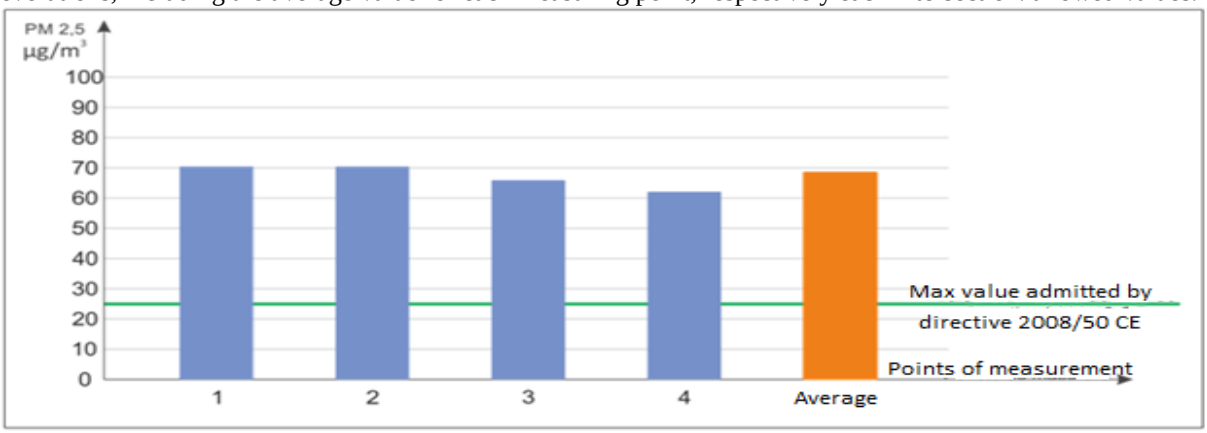

Figure 1 PM 2.5 variation at the intersection of Tudor Vladimirescu . with Calea Moţilor

The humidity and temperature conditions in these measurement stages do not greatly influence the measurements made, which is why in these measurement points we are concerned about the PM2.5 values which are both individual and average above the limit allowed by law in all points. . The composition of particles, their dependence on the emission source dictates the size of the particles, the mode of transport and especially the effects they have on human health, the natural environment. Predominantly, these particles contain soot or aerosols based on sulfates / nitrogen, having a predominantly acid character.

B. Table 2 Values determined in the area of the Economic College

number of points	place of measurements	hour	PM2,5 µg/m^3	PM10 µg/m^3	COV mg/m^3	CO2 ppm	T ^{0}C	humidity %	number of vehicles
1	On the street	12,20	67	88	1,38	565	16	61	78
2	In the yard 50m from the street	13,20	47	62	1,16	442	18	54	-
	Average values		57	75	1,27	503,5	17	57,5	

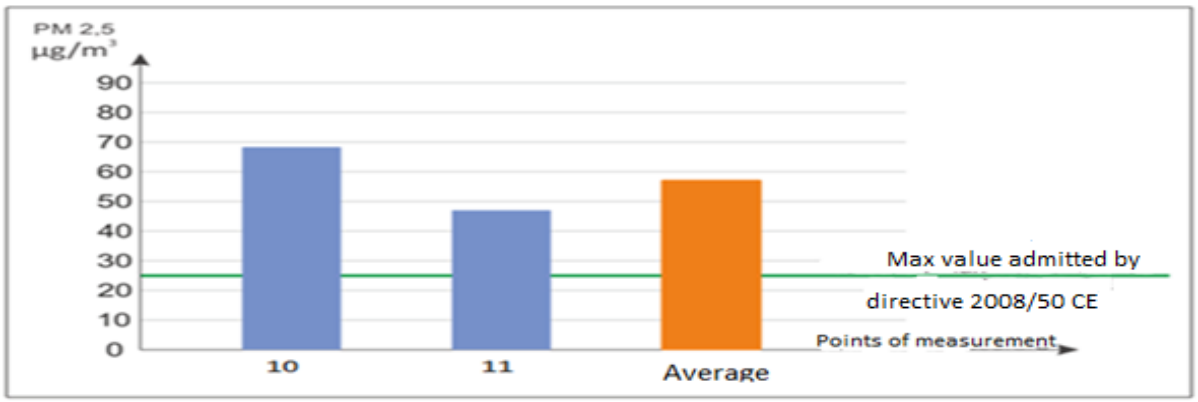

Figure 2 PM 2.5 variation in the area of the Economic College

C. Table 3: The values determined in the area of the Alba-Iulia County Hospital from 1989 Revoluției Street

number of points	place of measurements	hour	PM2,5 µg/m^3	PM10 µg/m^3	COV mg/m^3	CO2 ppm	T ^{0}C	humidity %	number of vehicles
1	Street - bus station	14,15	48	56	2,4	427	24	39,6	66
2	At the building 40m from the street	15,00	36	53	0,7	443	25,6	39,0	
3	In the yard 150m from the street	15,15	44	51	0,4	425	25,3	39,0	
	Average values		42,66	53,33	1,16	431.6	24,9	539,2	

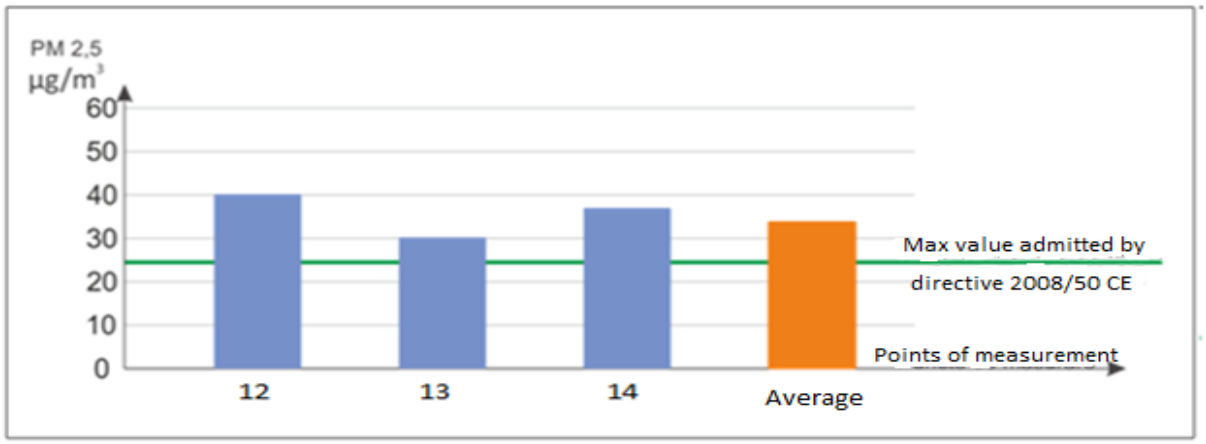

Figure 3 PM 2.5 variation in the County Hospital area

As we also mentioned in each area A, B, C, several measurements were made and the values of these values PM10, PM2.5 were averaged. The intensity of road traffic was also monitored by counting the number of vehicles.

Following the analysis of the measurements made, the following conclusions can be drawn:

- The average values of PM2.5 suspended particles was 69.25µg / m3,57 µg / m3 and 42.66 µg / m3
- The average values of PM10 suspended particles were 89.25 µg / m3, 75 µg / m3 and 53.33 µg / m3
- The average value of VOC volatile organic compounds was 5.65 mg / m3,1.27mg / m3 and 1.16 mg / m3
- The average value of the percentage of carbon dioxide was 549.5 ppm, 503,5 ppm and 431,6 ppm

IV. Conclusion and Directions to Follow

- To obtain real-time measurements, the Dust Trak Monitor Aerosol instrument was used, which detects the fractions PM10, PM2.5,
- All measurements were taken at the level of respiration, the sampling location being carefully selected to be free of any obstacles, and the distance from the sources of pollution at which the measurements were made was in accordance with legal provisions.
- Determinations were made in the periods specified for the two experimental stages of air quality monitoring, which coincided with two different seasons (autumn seasonand spring)
- The points chosen for the study targeted areas where children, pupils and the elderly are often present.
- The areas around the hospital and schools, kindergartens are relatively polluted with fine material particles, and at appreciable distances from the area with heavy traffic, respectively the school yard and the hospital, the legal limits have been exceeded.

- Analyzing the results of the measurements we came to the conclusion that the daily average measured is much higher than the one provided in the legislation the calculated average
- Local public authorities will follow these measures and then monitor carefully and continuously, the necessary measures now and in the future, based on various environmental projects with as a source of funding especially European funds
- Using student-specific public transportation to reduce congestion at these intersections and heavily trafficked areas,
- Solutions to address health problems in the homes of the elderly through specialized agencies, making green curtains in these areas to absorb more of these fine particles that caused what air currents.
- Use of electric vehicles; Maintaining street cleaning; Location of sound-absorbing and sound-insulating panels;
- use of bicycle, electric scooter, walking

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