Scientific Bulletin of Politehnica University of Timişoara

Transactions on HYDROTECHNICS

Volume 61(75), Issue 2, 2016

Considerations regarding air quality analysis using laboratory equipment

Nicoleta Sorina Nemeş [1] **Ioana Alina Creţan [2]**

Abstract: Air pollution can cause and aggravate respiratory diseases, cardiovascular damage forests, increase soil acidity and water can affect crops and cause corrosion of buildings. We can see that many air pollutants affect air quality in the future. The concentration of aerosol particles in the atmosphere is an important parameter for assessing air quality. The air is the faster propagation vector of the pollutants therefore it is necessary to investigate the atmosphere. Investigation of the atmosphere and the environment represent the foundation for understanding and why not to develop the direction of research, based on issues of urbanization and industrialization because it represents a cause of increased pollution, climate change, and propagating extreme events.

Keywords: air quality, laboratory equipment, respiratory diseases, climate change.

1. INTRODUCTION

Dry air is 99,964 %. If from the air would remove water vapor, nitrogen, oxygen, argon, air remaining 0,036 % air, that is the standard composition of the atmosphere that are composed of carbon dioxide (0.0325%), neon (0.00182%), helium (0.000524%), methane (0.00015%), krypton (0.000114%), hydrogen (0.00005%). The other three dominant gas are - nitrogen (78.84%), oxygen (20.946%) and argon (0.934%) [1].

The concept of air pollution refers not only to the presence of foreign substances but also the natural composition of air in quantities or concentrations that make it unfit for exercising its fundamental role, to support life. Air pollution has been defined by the Directive 84/360 EEC OF 28/06/1984 valid today: "The introduction into the atmosphere by man, directly or indirectly, of substances or energy having injurious likely to endanger human health, damaging the biological resources, ecosystems, damage to material possessions, recreational values and other utilities legitimate environment" [3].

2. MATHERIALS AND METHODES

In the laboratory of Water Treatment from Hydrotechnics Department of the Faculty of Civil Engineering, Politechnica University of Timişoara has a complex equipment for analises the air pollution, one of these beeing the aerosol monitor DustTrack 8533. They are portable, battery-operated, laserphotometers that measure and record airborne dust concentrations. The aerosol monitors have a custom designed weatherproof Environmental Enclosure for making the same accurate and precise measurements outdoors.

The DUSTTRAK aerosol monitor can be used for many different applications. While its primary use is in outdoor applications it may also be advantageous in indoor industrial applications to provide additional security and protection for the instrument. The enclosure should be set up in a location where it can easily sample the aerosols of interest. It should be placed away from obstructions which may affect wind currents.

The limit values and the averaging period for PM10 fraction of particulate matter in the atmosphere shall be established by Law 104/2011 on ambient air quality. (Framework Directive 96/62 / EC on air quality assessment and management) [4].

3. RESULTS AND DISSCUSSIONS

According to the specific literature the aerosol particles are referred to as particulate matter. The term aerosol particles are used by those skilled in the climatic effects, while specialists in the effects upon human health use the term "particulate matter „or simply PM.

Many epidemiological studies have shown that increasing concentrations of PM10 aerosol particles causes an increase in mortality if long-term exposure. It has been found and demonstrated that the material particles like PM10 and PM2.5 particulate matter are associated with respiratory disease and with cardiovascular disease.

Many of the aerosol particle properties and phenomena that occur are dependent on particle size. Therefore the most important parameter that characterizes the particle of the aerosol is their size particles [2]. To underline the importance of this property as well, namely „particle size" it was exemplified the fact that the rate of deposition of particles inhaled into the respiratory tract depends on particle size and is extremely important for assessing the risk of illness in the ambient air.

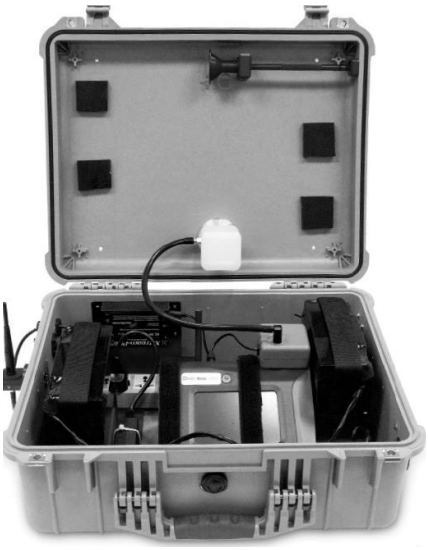
[1,2] Politehnica University of Timişoara, Department of Hydrotechnical Engineering, George Enescu Street, no.1A, Zip code 300022, Timişoara, Romania, e-mail: nicoleta.nemes@upt.ro

The concentration of aerosol particles is another parameter also very important. This parameter is significant near a source of pollution, and as we move away from the source it has important spatial variations influenced by a number of factors. For example, variations in the concentration of aerosol particles will be very different in urban areas compared to rural or industrial areas to adjacent zones.

Transport and diffusion processes have great importance, because it causes pollution of areas remote from the source site. During transport, processes like the mixing processes due to turbulence, scattering due to differences between wind speed and the speed of emission of the pollutant, but also the deviation from its initial course due to fluctuations of wind, are named diffusion. These processes are the way of dispersing of the particles in suspension.

To determine air quality, based on the amount of particulate matter have been made DustTrack mobile analyser measurements.

a)



b)

Figure 1. a), b) DustTrack mobile analisers

In the tables below are the results of such measurements of particulate matter in the surrounding area Timisoara respectively Mosnita localities. Measurements were carried out in several areas of Mosnita.

Table 1. Value determinate in sampling point: 1. The Castle

Value/parameter	PM1	PM2.5	RESP	PM10	TOTAL
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3
Medium	0,077	0,077	0,078	0,078	0,079
Minimum	0,072	0,073	0,073	0,073	0,073
Maximum	0,089	0,091	0,093	0,101	0,113

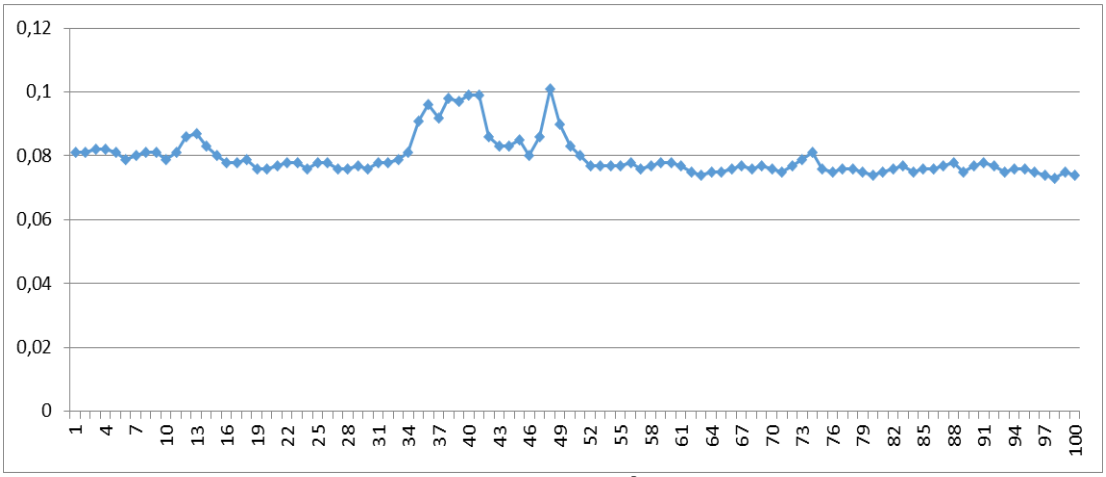


Figure 2. PM10 Concentration (mg/m^3) in sampling point 1

Table 2. Value determinate in sampling point: 2 Middle - left

Value/parameter	PM1	PM2.5	RESP	PM10	TOTAL
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3
Medium	0,065	0,066	0,066	0,066	0,066
Minimum	0,062	0,062	0,062	0,062	0,062
Maximum	0,069	0,07	0,07	0,078	0,078

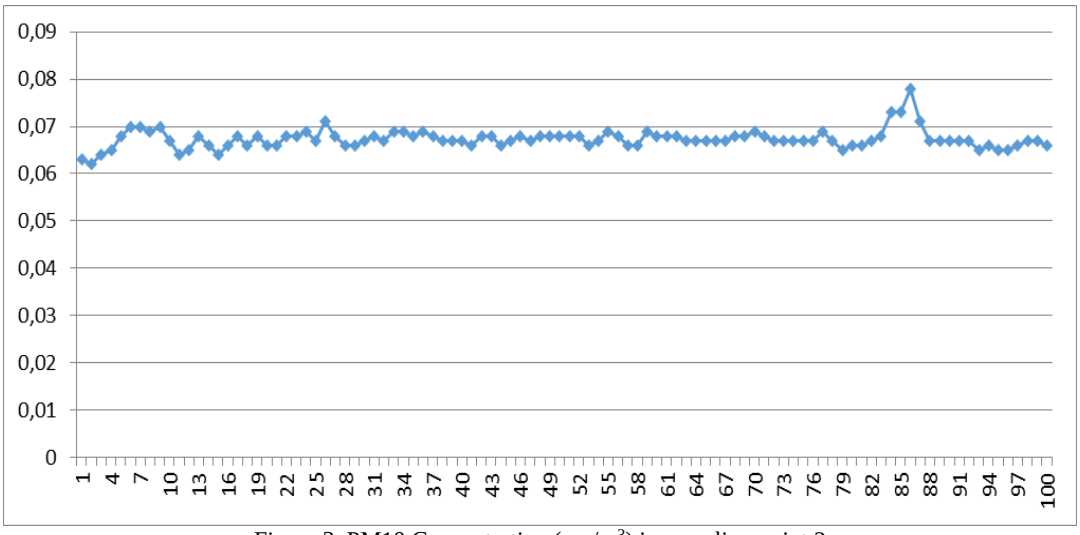


Figure 3. PM10 Concentration (mg/m^3) in sampling point 2

Table 3. Value determinate in sampling point: 3 Middle-right

Value/parameter	PM1	PM2.5	RESP	PM10	TOTAL
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3
Medium	0,062	0,063	0,065	0,067	0,068
Minimum	0,051	0,052	0,053	0,053	0,053
Maximum	0,176	0,201	0,226	0,254	0,254

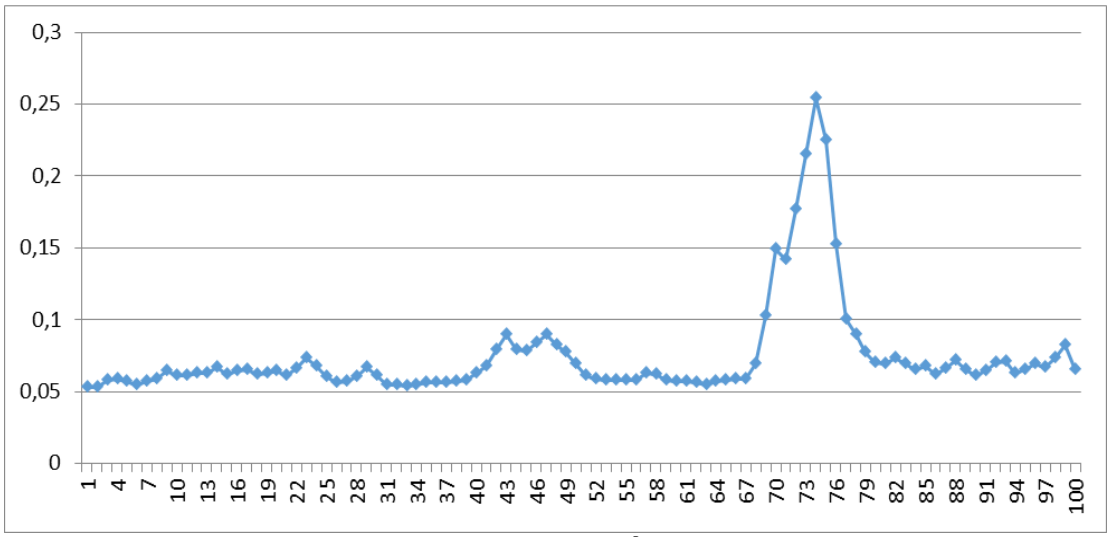


Figure 4. PM10 Concentration (mg/m^3) in sampling point 3

Table 4. Value determinate in sampling point: 4. exit to Albina

Value/parameter	PM1	PM2.5	RESP	PM10	TOTAL
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3
Medium	0,074	0,075	0,076	0,077	0,077
Minimum	0,06	0,06	0,06	0,06	0,06
Maximum	0,138	0,15	0,16	0,17	0,17

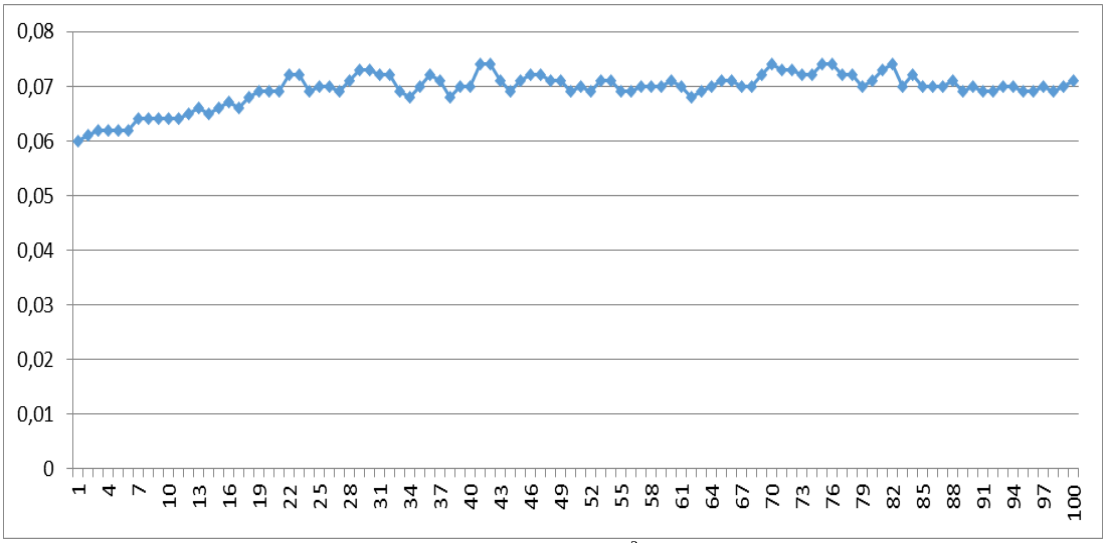


Figure 5. PM10 Concentration (mg/m^3) in sampling point 4

4. CONCLUSSIONS

To the air quality degradation, contributing sources in nature, but the major cause is the human activity, more intense.

Among possible sources of PM10 emissions with an important impact upon the air quality include: sources of industrial activity, the centralized and individual heating of the population, the power plants, road traffic and construction activity.

REFERENCES

[1] Seinfeld, J.H., Pandis, S.N., Atmospheric chemistry and physics. From air pollution to the climate change, Seconde Edition, John Wiley & Sons, 2006.

[2] A.T. Rusu, A. Suciu, T. Rusu, Air quality in urban area, International Conference „Profesolul Dorin Pavel", pg. 587-594, Sebes, 2015

[3] Directive 84/360 EEC OF 28/06/1984

[4] Law 104/2011 on ambient air quality