USING GRAVIMETRIC MEASUREMENT FOR DETERMINATION OF THE MASS FRACTION PM_{10} REGARDING THE PARTICLES IN SUSPENSION FROM TARGU MURES AREA.

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ABSTRACT

In this paper, we tried to determinate the air pollution level with mass fraction PM_{10} from Targu Mures area. For this purpose, determinations were made in University Petru Maior's laboratory, using ADR 1200 S device and in Targu Mures Environmental Department's laboratory. The results that we obtained show a low level of air pollution with mass fraction PM_{10} in Targu Mures area.

Keywords: gravimetric measurement, particles, suspension, Tg.Mures area.

1. Introduction

Particulate matter[1] (PM) is the sum of all solid and liquid particles suspended in air many of which are hazardous. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets.

These particles vary greatly in size, composition, and origin.

Particulate matter present in air is divided into different categories depending on the size of the particles (aerodynamic diameter).

Coarse particles are the relatively large airborne particles mainly produced by the mechanical break-up of even larger solid particles.

Examples of coarse particles include dust, pollen, spores, fly ash, soot, fog, fumes and plant and insect parts.

PM suspended particulate matter, total suspended particulates, black smoke, inhalable particles, thoracic particles, respirable particles.

Sum of all microscopic solid and liquid particles, of human and natural origin, that remain suspended in a medium such as air for some time. These particles vary greatly in size, composition, and origin, and may be harmful.

Based on the size of their aerodynamic diameter particles can be classified as PM_{10} (coarse and fine particles), $PM_{2.5}$ (fine particles) or $PM_{0.1}$ (ultrafine particles).

2. How are particles formed

Coarse particles are produced by the mechanical break-up of larger solid particles. The coarse fraction can include dust from roads, agricultural processes, uncovered soil or mining operations, as well as non-combustible materials released when burning fossil fuels. Pollen grains, mould spores, and plant and insect parts can also contribute to the coarse fraction. Finally, evaporation of sea spray can produce large particles near coasts.

Sulfate and organic matter are the two main contributors to the annual average PM_{10} and $PM_{2.5}$ mass concentrations, except at kerbside sites where mineral dust (including trace elements) is also a main contributor to PM_{10}. On days when $PM_{10} > 50$ $\mu g/m^3$, nitrate becomes also a main contributors to PM_{10} and $PM_{2.5}$. Black carbon contributes 5–10% to $PM_{2.5}$ and somewhat less to PM_{10} at all sites, including the natural background sites. Its contribution increases to 15–20% at some of the kerbside sites. Because of its complexity and the importance of particle size in determining exposure and human dose, numerous terms are used to describe particulate matter. Some are derived from and defined by sampling and/or analytic methods, e.g. "suspended particulate matter", "total suspended particulates", "black smoke". Others refer more to the site of deposition in the respiratory tract, e.g. "inhalable particles", which pass into the upper airways (nose and mouth), and "thoracic particles", which deposit within the lower respiratory tract, and "respirable particles", which penetrate to the gas-exchange region of the lungs. Other terms, such as "PM_{10}", have both physiological and sampling connotations.

These particles are small enough to remain suspended for hours or days, being able to travel long distances in this range. Since the substance

[1] www.greenfacts.org

involved is usually heterogeneous, can not be used and molar mass and that is why concentrations are given in terms of particle mass and not number of moles. As usual units are micrograms of particulate matter per cubic meter of air (µg/m3). Considering that smaller particles have a greater harmful effect on human health than larger ones, usually only those that have a certain diameter or smaller than this are collected and reported. This diameter limit in µm, is listed as an index to the symbol PM. In recent years, government agencies in most countries monitored PM_{10}, which is the total concentration of all particles with diameters less than 10 µm, which corresponds to all areas of fine particles, plus the lower classes of gross particles, all of which are called particles can be inhaled. The allowable amount of PM_{10} in an urban area is 50 µg/m3.

Today it is used increasingly $PM_{2,5}$[2] index, which includes all fine particles with diameters under 2.5 µm, also called respirable particles. Causes and sources of particles in suspension occurrence are:

- combustio processes which emit incompletele burned soot or anorganic ashes resulting mostly from burning coal;
- materials used for shredding, crushing, grinding the minerals, loading and handling or dry materials;
- can be formed by reactions of gases in the atmosphere - sulphate or nitrate results as secondary pollutants in atmospheric reactions;
- come from natural causes such as for exemple volcanoes, polen, dust drift and smoke due to forest fires;
- "smoke", containing polycyclic aromatic hydrocarbons (PAHs), some of which are carcinogenic, which result from incomplete combustion of coal or other fuels;
- fine dust resulting in some busy streets;
- residues containing lead resulting from use of leaded petrol;
- asbestos from various sources

3. The experimental part

Reference Method for PM10 sampling and measurement is described in EN 12341 / 2002 Air Quality[3].

The measurement principle is based tocollection on the filters PM_{10}, $PM_{2.5}$ fraction by passing a certain volume of air. The collection is for a period of 24 hours. The final result, expressed in µg/m3, is the mass of particles collected by report the volume of air that passed through the filter. The content of PM10 sample is calculated using the relationship:

$$PM_{10} = m_1 – m_2/ V$$

where:

m1 = mass filter after exposure;
m_2= filter mass before exposure;
V= volume of air aspirated

For laboratory determinations was used device ADR 120 S, to determine the ground, fixed in the city of Targu Mures was used device Tecora. Determinations were made between February and May 2011. For example we chose April and May, 2011.

Day	$PM_{2.5}$ [µg/m^3]	PM_{10} [µg/m^3]
1/4/2011	5,97	7,56
2/4/2011	7,85	20,39
3/4/2011	6,77	13,05
4/4/2011	5,38	10,06
5/4/2011	7,83	11,02
6/4/2011	2,72	6,33
7/4/2011	10,01	16,92
8/4/2011	20,0	31,06
9/4/2011	18,99	31,86
10/4/2011	12,32	13,47
11/4/2011	5,44	4,26
12/4/2011	10,07	15,54
13/4/2011	9,1	16,01
14/4/2011	12,76	24,9
15/4/2011	8,33	9,63
16/4/2011	7,05	8,16
17/4/2011	11,66	17,45
18/4/2011	13,38	18,14
19/4/2011	13,2	25,14
20/4/2011	10,33	12,44
21/4/2011	16,23	20,3
22/4/2011	9,93	20,41
23/4/2011	11,58	23,09
24/4/2011	9,51	25,32
25/4/2011	12,96	23,18
26/4/2011	13,97	12,56
27/4/2011	11,22	22,19
28/4/2011	7,48	10,9
29/4/2011	6,89	13,6
30/4/2011	10,89	31,4

[2] SR EN14907/2007 Ambient air quality. Standardized measurement method for determining gravimetric $PM_{2.5}$ mass fraction of particles in suspension.

[3] SR EN 12341/2002 Air Quality. Determination of PM_{10} located as a powder in suspension.

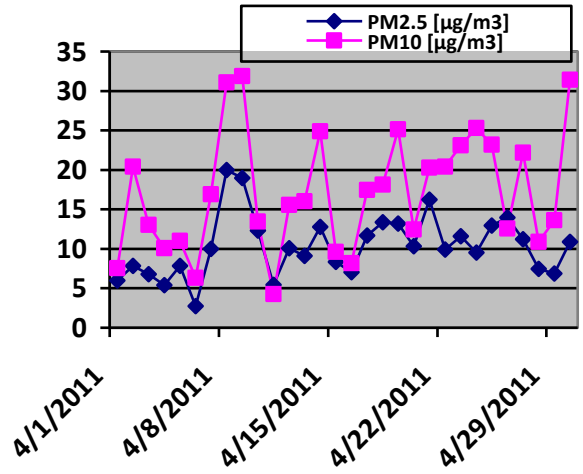

Fig. 1 Daily variations April 2011

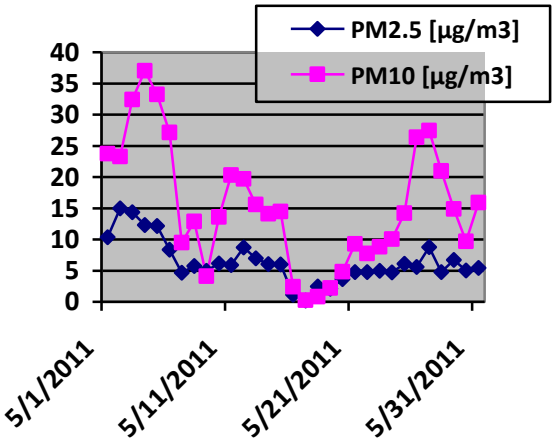

Fig. 2 Daily variations May 2011

Day	$PM_{2.5}$ [µg/m^3]	PM_{10} [µg/m^3]
1/5/2011	10,36	23,73
2/5/2011	14,96	23,28
3/5/2011	14,34	32,41
4/5/2011	12,3	37,01
5/5/2011	12,17	33,25
6/5/2011	8,36	27,14
7/5/2011	4,66	9,47
8/5/2011	5,74	12,89
9/5/2011	5,0	4,09
10/5/2011	6,14	13,61
11/5/2011	5,89	20,32
12/5/2011	8,7	19,7
13/5/2011	7,0	15,58
14/5/2011	6,03	14,08
15/5/2011	6,01	14,45
16/5/2011	1,15	2,39
17/5/2011	0,18	0,27
18/5/2011	2,48	0,8
19/5/2011	2,12	2,22
20/5/2011	3,62	4,82
21/5/2011	4,78	9,26
22/5/2011	4,79	7,74
23/5/2011	4,98	8,81
24/5/2011	4,7	10,03
25/5/2011	6,12	14,2
26/5/2011	5,59	26,35
27/5/2011	8,76	27,42
28/5/2011	4,79	20,99
29/5/2011	6,73	14,88
30/5/2011	5,05	9,69
31/5/2011	5,43	15,9

4. Results and conclusions

A first important conclusion from the analysis is required above results is that the concentration of atmospheric micro particles in Tg. Mures area, is not exceeded, all recorded values are below limits.

Daily variations recorded quite large, are closely related to weather, wind speed, the day of the week. Weekends bring more traffic than a decrease in industrial activity and therefore a decrease in concentration of micro particles. This behavior is similar for both PM2.5 and PM10, we can easily see on the graph overlap almost perfectly maxima and minima of the two types of micro particles.

5. Bibliografie

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