AIR QUALITY MONITORING IN GALAȚI. CASE STUDY

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ABSTRACT

This paper presents information referring to the variation of aerosols concentration in a central area in Galati. For a period of time of november2005 to november 2006, there have been made correlations between aerosols concentrations and the predominant wind directions (E~W, N~NE~S-SW).

The results of the measurements are specific only for a point in time, being influenced by random variables (traffic intensity, temperature, pressure, wind speed, humidity etc.).

KEYWORDS: aerosol, pollution, particulate matter, air quality.

1. Introduction

The aerosols are systems of solid or liquid particles suspended in a gaseous medium, having a negligible falling velocity. Aerosols include a wide range of phenomena such as dust, fume, smoke, mist, fog, haze, and smog [1].

Aerosols may be produced either by ejection or emission into the atmosphere (primary aerosol production) or by physical and chemical processes within the atmosphere (secondary aerosol production) [3]. Particles in the atmosphere arise from natural sources as well as anthropogenic activities [1]. The former source includes wind blown dust, sea spray, volcanic activities and biomass burning, while emissions of particles attributable to the activities of humans primarily arise from four source categories: fuel combustion, industrial processes, nonindustrial fugitive sources (e.g. construction work) and transportation sources (e.g. automobiles) [1]. Atmospheric aerosols are generally considered to be particles that range in size from a few nanometres (nm) to several hundred micrometers (µm) in diameter. The particulate matter (PM) with a diameter, *d,* of 2.5 µm is referred as $PM_{2.5}$ and a diameter of 10 µm is referred as PM_{10} (EPA[1], 1997).

The smallest aerosols are small enough to get into the human respiratory system. British standards define the respirable fraction as those aerosols smaller than 5 µm, which is a significant proportion of the total [3]. The size of particles is directly linked to their potential for causing health problems. Small particles less than 10µm produce the greater problems, because they can get deep into the lungs, and some may even get into the bloodstream. Larger particles are of less concern, although they can irritate eyes, nose, and throat [2]. Particle mass concentrations are therefore regulated in the US and EU legislation. However, the ultrafine particles (UFP, i.e. having diameters less than 0.1 µm) are considered especially detrimental to human health, since these particles can be inhaled and deposited deep in the alveoli of human lungs.

Moreover, epidemiological studies suggest a connection between both UFP and PM concentration and mortality. Effects of PM were clearer in respiratory cases, whereas effects of UFP were clearer in cardiovascular cases. The largest particles are removed by settling and impaction in the head airways. Ultrafine particles less than 0.01 µm can also have significant deposition in this region due to their high diffusivity. In the tracheobronchial region, impaction and settling are important for particles larger than 0.5 µm although the overall deposition fraction in this size range is quite small.

2. Experimental research

2.1. Air quality monitoring location

Wind direction is a crucial parameter for the regional pollution as it indicates the origin of the air mass and the relative position of the measuring sites to the main pollution sources. The air quality has been monitored from autumn 2005 to autumn 2006 by “Environmental Engineering” laboratory of the Faculty of Metallurgy and Materials' Sciences, University "Dunărea de Jos" of Galati.

[1] EPA – Environment Protection Agency, USA.

The monitoring activity led to finding and accumulating information on the atmospheric aerosols charge in the neighborhood of Carnabel and Garii crossing (fig. 1).

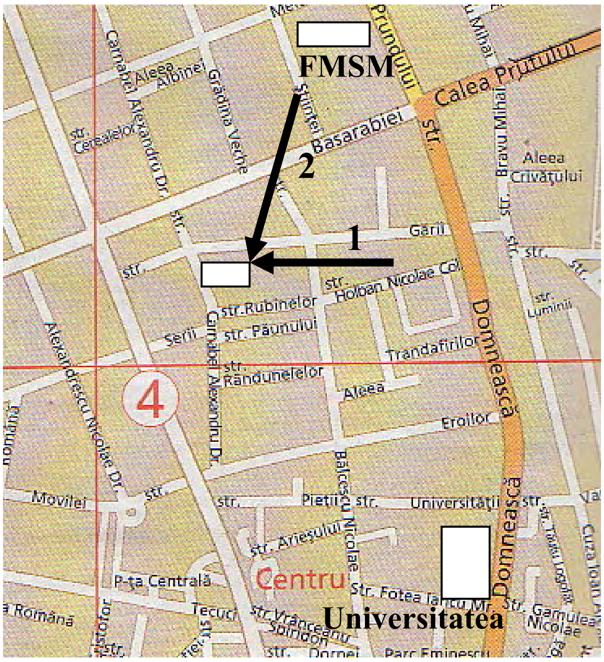

***Fig. 1.** Location of the experimental research, marked on the map of Galati, wind direction: 1- E~W, 2 - N-NE~S-SW.*

In this area, due to the extremely intense traffic, supplementary pollutants were added to the pollutants occurring from industrial plants emissions. Information on aerosols concentration size ranges a = (0.4-0.5) µm, b= (0.5-0.6) µm, c = (0.4-6-0.7) µm, d = (0.7-0.8) µm, e = (0.8-0.9) µm, f = (0.9-1.0) µm, g = (1.0-1.5) µm, h = (1.0-1.5) µm, i = (1.5-2.0), , j = (2.0-4.0), and k = (4.0-10.0), µm was collected and processed. It was determined the level of air pollution with respect to wind direction in the area.

2.2. Experimental data

For the experimental research a particles’ counter type AC-3 was used, which can determine up to 750,000 particles with size range of 0.4-10 µm in 1 dm^3 of ambient air. It is stated that atmosphere is considered polluted if there are more 450,000 particles/dm^3 of air.

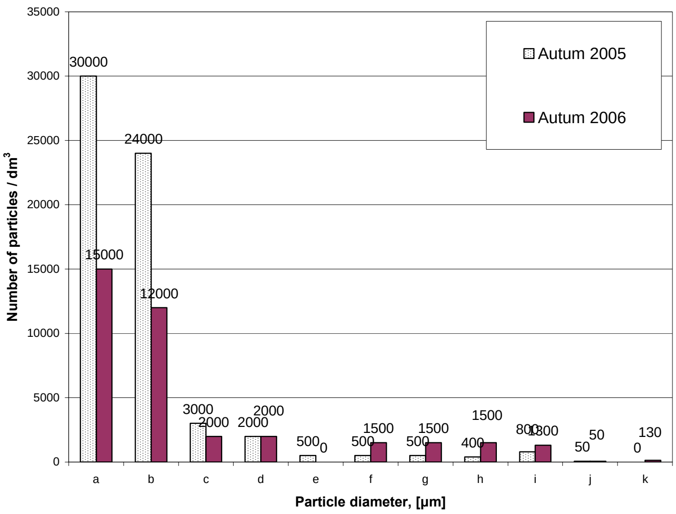

***Fig. 2.** The variation of concentration in particles of 0.4-10.0 µm, when wind direction is E~W.*

The meteorological bulletins for Galati were added as supplementary data to the initial measurements, several factors being written down (temperature, humidity, atmospheric pressure, the point, the direction and the speed of the wind).

This paper analyses the most frequent wind direction dependence of the particle size distribution, as it was noticed that aerosols charge in atmospheric air varies significantly with wind direction.

The experimental data were grouped in four predominant wind directions, as it follows: E~W (fig.2) and N-NE~S-SW (fig.3). The graphics below present the particle size distribution (in 1dm^3 of air) for the period of autumn 2005 to autumn 2006.

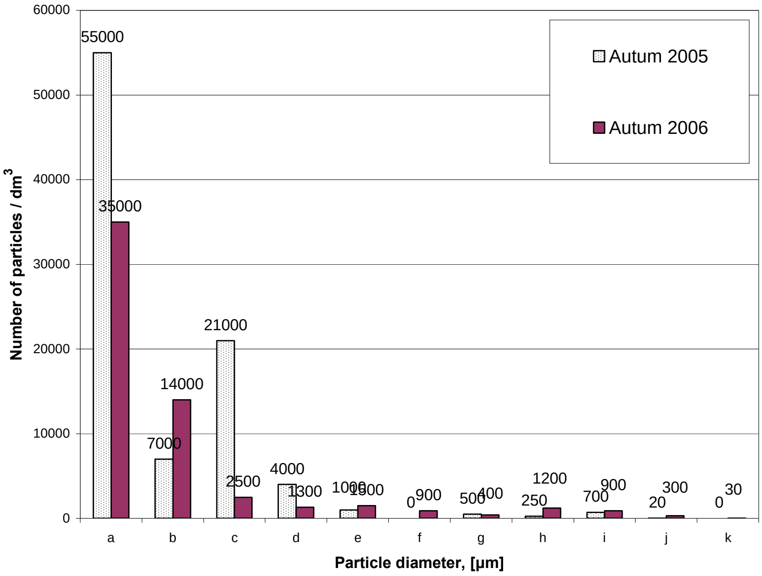

***Fig. 3.** The variation of concentration in particles of 0.4-10.0 μm, when wind direction is N-NE~S-SW.*

4. Conclusions

- The monitoring activity led to finding and accumulating information on the atmospheric aerosols charge in the neighborhood of Carnabel and Garii crossing. In this site the concentration of particles is small 55 000 particles/dm^3;
- The predominant wind directions as it follows: E~W and N-NE~S-SW, in autumn 2005 and autumn 2006 period;
- The dates of diagrams were obtained by arithmetic’s average at all experimental dates for each period;
- Winds from E~W direction (fig. 2), the concentration of particles are in larger quantities than the 0.4-0.6 µm, but they have a lower concentration than the 0.6-10.0 µm;
- Winds from E~W direction, the concentration of particles in autumn 2005 was twice more than autumn 2006;
- Winds from N-NE~S-SW direction (fig. 3), the concentration of particles are in larger quantities than the 0.4-0.7 µm, but they have a lower concentration than the 0.7-10.0 µm;
- Winds from N-NE~S-SW direction, the concentration of particles in autumn 2006 was lower than autumn 2005;
- Winds from N-NE~S-SW is associated with continental and therefore more polluted air masses.

References

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