Source apportionment of size resolved particulate matter in European air pollution hot spot

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The ambient aerosol source composition is particle size dependent (Dodd, 1991). Therefore, to improve the accuracy of aerosol source apportionment, size segregated aerosol measurement with high time resolution is required (Han, 2005; Peré-Trepat, 2007). The objective of presented study was to identify sources of size resolved ambient aerosols in industrial city Ostrava in Czech Republic, Central Europe.

Measurements were conducted from 26th Jan to 21st Feb 2012 in Ostrava city in the north-east part of the Czech Republic. The heavy industrialized city, accumulation of steel industry and coke plants, counts among the worst air quality region in EU.

A Davis Rotating-drum Uniform-size-cut Monitoring (DRUM) was used to sample with 1-h time resolution aerosol particles of aerodynamic diameter D_p for three size modes A (10 μm > Dp > 1.15 μm), B (1.15 μm > Dp > 0.34 μm) and C (0.34 μm > Dp > 0.1 μm). Aerosol masses were calculated from five minute data by Aerodynamic Particle Sizer, APS (3321, TSI) and Scanning mobility Particle Sizer, SMPS (3963, TSI). To evaluate middle-scale $PM_{2.5}$ variability in an urban airshed, $PM_{2.5}$ measurement by 7 laser photometers DustTrak, DT (8520, TSI) in a network arrangement was conducted. Complete meteorology wind speed (WS) wind direction (WD), temperature (T), relative humidity (RH), global radiation (GR), precipitation (P) were also concurrently recorded.

A bilinear receptor model, EPA PMF 4.2.0.0, was used to resolve the possible sources for 60 minutes mass integrates for three sizes m as measured by APS and SMPS and elemental composition for 28 elements sampled by 3DRUM analyzed by S-XRF.

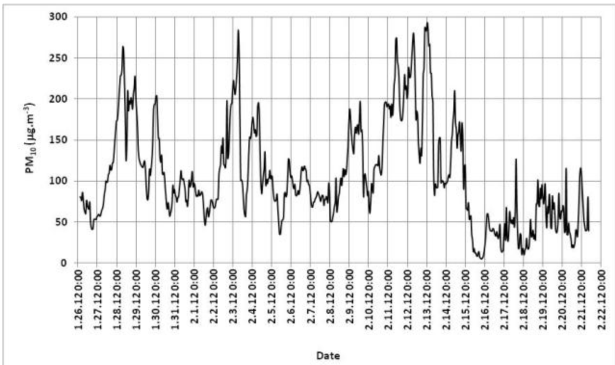

Figure 1. Temporal trend of PM_{10} hourly averages.

According to the different meteorological condition and PM_{10} levels the measuring campaign was separated into two periods, smog and after smog. The smog period characterized low T (median=-14.8 °C), WS (median=0.7 m.s^{-1}), WD prevailing from NE and high PM_{10} (median=108 μg.m^{-3}) lasted from 26th Jan to 14th Feb. The after smog period (15th – 21st Feb) was characterized by grow of T (median=-1.7 °C), WS (median=1.1 m.s^{-1}), WD prevailing from NW to SW and precipitation, which resulted in PM_{10} decrease (median=40.1 μg.m^{-3}) (Figure 1.). The median of three size fraction (A, B and C) during smog episode and after is quoted in the Table 1.

Table 1. The three fraction median value for smog and after smog episode in Ostrava 26th Jan-21st Feb 2012.

Size fraction	**Smog**	**After smog**
	median (μg.m^{-3})	
A	22.1	11.5
B	39.1	10.8
C	47.6	15.4

The $PM_{2.5}$ inter-DT differences in the course of measurement were not statistically significant. We may conclude, that the monitoring station was well positioned and the measurements eligible at least for a middle scale of urban airshed.

The PMF resolved from five to six possible sources related to the size fraction. The sources of B and C fraction corresponded to each other from 83 % (5 sources from total number of 6 sources). The A fraction sources matched with the two fraction sources from 60 % (3 sources from total number of 5 sources). The antrophogenic sources industry, combustion and traffic (exhausted and nonexhausted emission) contributed most to PM_{10}.

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