Elemental composition and source identification of $PM_{0.09-0.26}$ 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). Usually, mode of aerosol particle number distribution is within 80-130 nm the objective of presented study was to identify sources of $PM_{0.09-0.26}$ 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. Mainly due to accumulation of steel industry and coke plants, the city counts among the worst air quality region in EU.

$PM_{0.09-0.26}$ was sampled by the 8 stage Davis Rotating-drum Uniform-size-cut Monitoring (8DRUM) with 2-h time resolution (last stage of 8DRUM). The 120 minute integrates of aerosol mass within the desired size range was calculated from five minute data by Scanning mobility Particle Sizer, (SMPSL-3936, L-25, TSI) Also $PM_{2.5}$ by 7 laser photometers DustTrak, DT (8520, TSI) were measured to evaluate PM2.5 middle-scale variability. 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 120 minutes integrations of mass concentrations with size interval 91.4 – 259.5 nm and elemental composition for 28 elements analyzed by S-XRF at the Advanced Light Source, Lawrence Berkeley National Laboratory, CA.

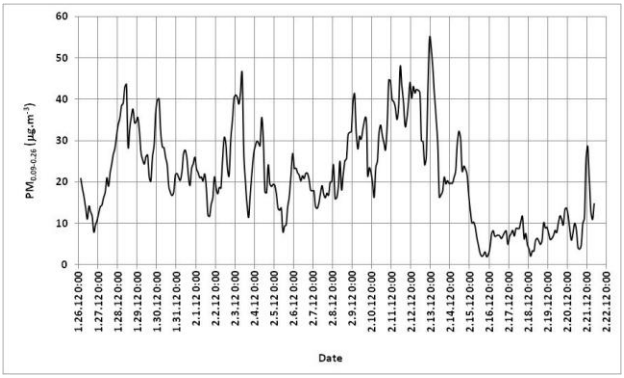

Figure 1. Dynamics of two hours averages of $PM_{0.09-0.26}$ in Ostrava 26.1-22.2. 2012.

According to the different meteorological condition and $PM_{0.09-0.26}$ concentration is it possible to separate the measuring campaign to two periods. The smog period characterised by low T (median=-14.8 °C), WS (median=0.7 $m.s^{-1}$), WD prevailing from NE and high $PM_{0.09-0.26}$ (median=23.4 $\mu g.m^{-3}$) lasted from 26th Jan to 14th Feb. The after smog period (15th – 21st Feb) was characterised 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 $PM_{0.09-0.26}$ decrease (median=7.4 $\mu g.m^{-3}$) (Figure 1.). The $PM_{0.09-0.26}$ median values of elements with highest total mass concentration measured during the sampling campaign are quoted in the Table 1.

Table 1. The $PM_{0.09-0.26}$ median values of main elements.

Element	Median ($ng.m^{-3}$)	Element	Median ($ng.m^{-3}$)
Na	65.2	K	63.5
Si	13.3	Fe	5.3
S	285.1	Zn	17.5
Cl	19.9	Pb	6.9

The $PM_{2.5}$ inter-DT differences in the course of measurement were not statistically significant. As result the monitoring station position was eligible and air monitoring data representative for the urban environment.

The PMF resolved six possible factors of them two were identified to account for about 70 % and 20 % of $PM_{0.09-0.26}$ mass respectively. The first was related to Pb, Cu, Co and S and the second to As, Zn, K and S. Both the sources were attributed to high temperature processes.

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Dodd, J.A., Ondov, J.M., Tuncel, G., Dzubay, T.G., Stevens, R.K. (1991) *Environ. Sci. & Techol.* **25**, 890-903.

Han, J.S., Moon, K.J., Ryu, S.Y., Kim, Y.J., Perry, K.D. (2005) *Atmos. Environ.* **39**, 3113–3125.

Peré-Trepart, E., Kim, E., Paatero, P., Hopke, P.K. (2007) *Atmos. Environ.* **41**, 5921-5933.