Comparison of Source Apportionment Results from Summer and Winter Measuring Campaign at a Prague-Suchdol Site

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COMPARISON OF SOURCE APPORTIONMENT RESULTS FROM SUMMER AND WINTER MEASURING CAMPAIGN AT A PRAGUE-SUCHDOL SITE

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INTRODUCTION

Organic aerosol (OA) is the most abundant but still poorly characterized component of airborne particulate matter. This situation is even more complicated in large cities where many anthropogenic sources of primary organic aerosol (POA) are situated. In recent years, aerosol mass spectrometry has been increasingly applied to obtain highly time-resolved chemical composition of ambient aerosol. This is considerably important for clarification of organic aerosol life cycles and sources. Two measuring campaigns, which lasted about six weeks in summer 2012 and in winter 2013, were performed at suburban site Prague – Suchdol. Aerosol data were measured by Aerodyne compact time-of-flight aerosol mass spectrometer (AMS) which is able to characterize the size resolved chemical composition of non-refractory submicron (PM_1) fraction.

DATA PROCESSING

Organic aerosol data were averaged to 30 min. intervals and analyzed by receptor modelling based on positive matrix factorization. Firstly, a set of factors is identified by unconstrained technique using Multi-linear engine (ME-2) (Paatero, 1999). Mass spectra of these factors correspond both to primary organic aerosol (POA) sources and secondary organic aerosol (SOA) sources. We distinguished various primary sources depending on season. In summer season we identified hydrocarbon-like organic aerosol (HOA) from traffic and OA emitted by and biomass burning (BBOA). In winter season we found two types of POA both connected with local heating. Wood burning (WBOA) and Coal burning (COAL) aerosols. POA portion was ranging from 10% to 20% of total organic aerosol in summer and from 10% to 40% in winter season. In both parts of the year SOA consists of two types of oxygenated organic aerosol varying in volatility and degree of oxidation. Semi-volatile oxygenated organic aerosol (SV-OOA) shows maximal concentration during the night and minima in the afternoon. Low-volatile oxygenated organic aerosol (LV-OOA) has an opposite daily pattern and is more oxidized then SV-OOA. Mass spectra of all detected POA factors were then put more precisely by ME-2 partially constrained technique: a-value approach (Canonaco, 2013).

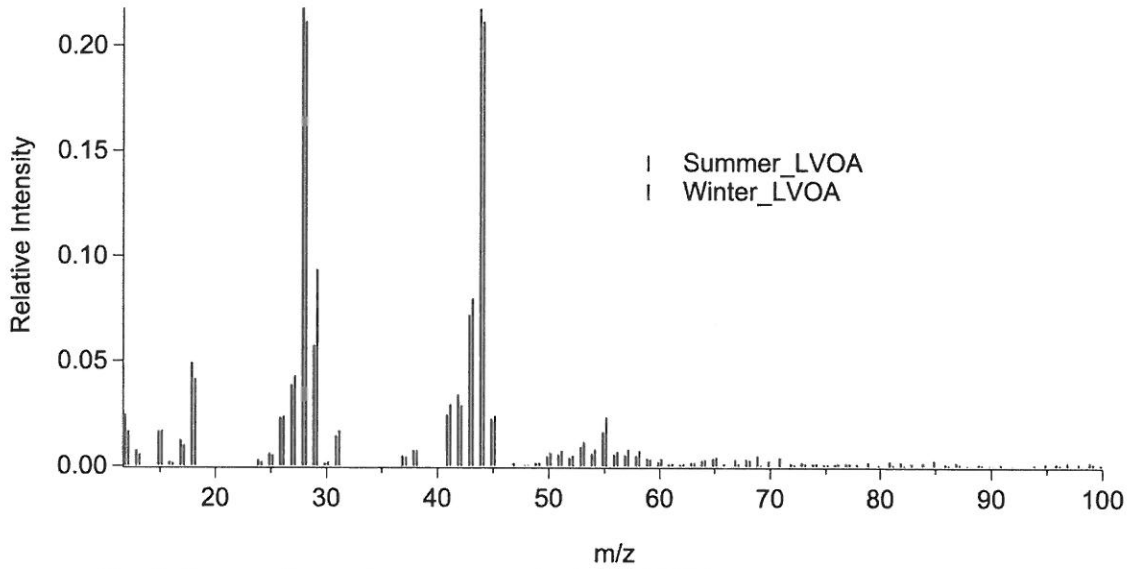

Fig. 1: Comparison of summer and winter LVOA mass spectra

RESULTS AND CONCLUSIONS

In both seasons ME-2 analysis resolves two POA sources and two SOA sources. The same SOA sources were identified in summer and winter. Pearson's correlation coefficient R showed high degree of similarity ($R_{LVOAsummer, LVOAwinter}$ = 0.99, $R_{SVOA\ summer, SVOA\ winter}$ = 0.79). During winter season we were not able to resolve HOA factor clearly. We may assume that the low amount of HOA was included in COAL factor due to high similarity of HOA to COAL factor ($R_{HOA,COAL}$ = 0.81). Summer BBOA factor showed high similarity to WBOA factor ($R_{BBOA,WBOA}$ = 0.81).

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REFERENCES

Canonaco, F., Crippa, M., Slowik, J. G., Baltensperger, U., and Prévôt, A. S. H.: Atmos. Meas. Tech., 6, 3649–3661, doi:10.5194/amt-6-3649-2013, 2013

Paatero, P. The multilinear engine – a table-driven least squares program for solving multilinear problems, including the n-way parallel factor analysis model. J Comput Graph Stat. 1999;8:854–888.