Particulate Matter in Indoor Air in two Schools in Vienna, Austria

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Sampling of particulate matter was performed in two schools in Vienna in 2011. The first campaign started in January and lasted until April, the second from October till December, respectively. Particulate matter (PM10) was collected in parallel with a high-volume sampler (Digitel DHA80) using quartz fibre filters, a low-volume sampler (Leckel, SEQ47/50) using cellulose acetate filters and a beta particulate monitor (ESM, Eberline). In addition to the characterization of indoor air the sampling equipment was also installed outside the buildings for at least one week during both campaigns. This allowed to determine the ambient PM10concentrations in the vicinity of the two schools and to compare them with the air quality network in Vienna. This comparison showed very good agreement and allowed to take data from the air quality network as ambient concentration data for the time of the indoor sampling. Filter samples were analysed for aerosol mass, water soluble ions, carbon parameters (total carbon, elemental carbon, organic carbon, carbonates) selected anhydrosugars and other saccharides, cellulose, humic like substances and metals using protocols described in Bauer et al. (2007).

Both sampling sites were located in the western part of Vienna. The vicinity of HBLVA Rosensteingasse (RG) can be characterized as a densely populated residential area with some influence of local traffic. The other site, BG Fichtnergasse (FG), is also a residential area with a large number of single family houses and private gardens around. Average concentrations of particulate matter in the ambient were ranging from 20 µg/m³ (April at FG) to 81 µg/m³ (November at RG). Sampling times comprised most of the exceedances of the 24h-limit value of PM10 observed in Vienna during 2011.

As expected indoor particulate matter concentrations showed distinct daily and weekly cycles reflecting the activity of students and teachers moving around the building and vaccations or weekends. Superimposed to these short time fluctuations the concentrations are driven by the ambient air concentrations monitored within the air quality network in Vienna.

Chemical analyses accounted for approx. 90 % of aerosol mass using a macro-tracer model (Bauer et al. 2007) which allows to quantify the contributions of inorganic secondary aerosols, mineral dust, wood smoke, other organic material and traffic to aerosol mass. For indoor samples organic material gave the highest contribution to aerosol mass, with cellulose being the most dominant single compound measured. Furthermore pronounced differences of saccaride concentration patterns were observed by comparing indoor and ambient air samples. Thus sugar alcohols being tracers for fungal spores (Bauer et al. 2008) were only determined outside, while e.g. glucose, fructose and succrose were only determined in indoor air samples. In FG mineral dust and in RG inorganic ions were the second important contributors to aerosol mass, respectively. Traffic showed a similar and rather small contribution at both sampling sites.

For ambient air samples inorganic secondary aerosol is the most important contributor to aerosol mass, followed by mineral dust, wood smoke and other organic material.

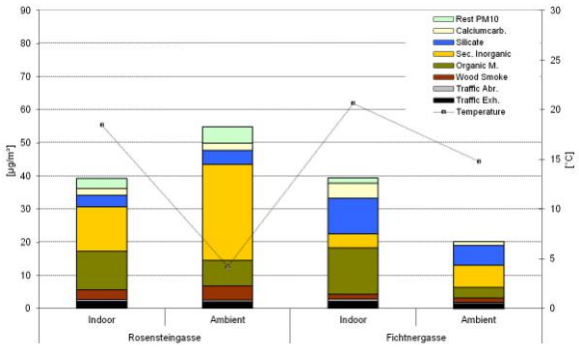

Figure 1. Source apportionment in the first campaign.

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