Particle-bound Methoxyphenols and their atmospheric nitration products as wood combustion tracers

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In many countries all over the world generation of heating energy wood is still the major source for heating and cooking or has even started a renaissance, respectively. The application of wood is quite cheap but enforces environmental problems and health risks. This indicates, that the question of the linkage between Environment and Health, due to economical reasons, more and more becomes a question of the linkage between Energy and Health.

For elucidation and validation of air polluters, responsible sources must be well indicated by suitable source tracer compounds. Since most of the emitted compounds from wood combustion are highly degradable within the atmosphere, it is worth to examine their atmospheric reaction products, too. Therefore we investigated on methoxyphenols and their reaction products with NO_3-radicals. In a winter sampling campaign in the city of Augsburg, Germany, methoxyphenols and their related products were monitored by high resolution PM_1 filter sampling. By hourly filter changing 24 samples were collected a day. Filters were analyzed with a highly sensitive insitu-derivatization-thermal-desorption gas-chromatography time-of-flight-mass-spectrometry method (IDTD-GC-TOFMS) (Orasche et al. 2011). One step before methoxyphenols were well identified by emission measurements at different combustion conditions within a dilution sampling set-up (e. g. Orasche et al. 2013).

As described by Liu et al. (2012) for reaction chamber experiments a clear dependency of nitration products to NO_3-radicals can be observed. The NO_3 concentrations were related to the increasing NO_x-concentrations during the night time due to missing photo-oxidation-reactions. Figure 1 visualize this relationship between NO_2 and Hydroxynitrobenzene. The rise of concentrations takes place one to two hours later than increase of those of the precursors. Figure 2 shows the correlation between syringaldehyde and 2,6-Dimethoxynitrophenol. It indicates that an additional reaction pathway of syringaldehyde has to be discussed.

The results are indicating that in future source apportionment studies stable secondary organic aerosols (SOA) should be involved to avoid underestimation of specific sources. Moreover the health effects of compounds like the nitrated methoxyphenols have to be investigated carefully.

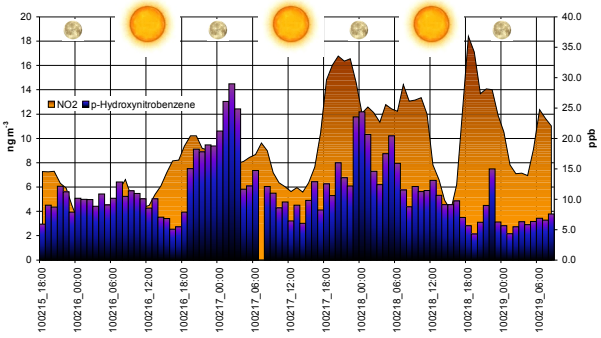

Figure 1. The relationship of p-Hydroxynitrobenzene and NO_2 during day- and night-time.

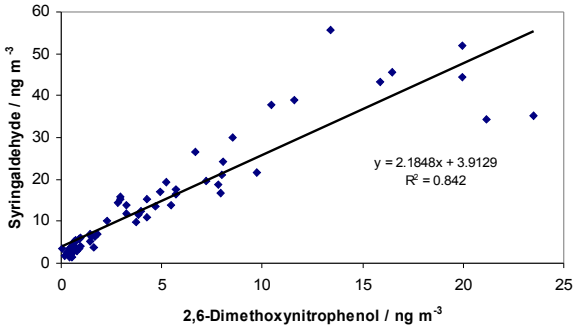

Figure 2. Correlation between Syringaldehyde and 2,6-Dimethoxynitrophenol.

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