Modification of the chemical composition of different wood combustion aerosols during aging process

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Emissions of residential wood combustion are becoming an increasingly important cause of air quality problem since wood has evolved to a popular source of alternative energy to fossil fuel. Additionally, wood combustion particles are suspected to exert adverse effects upon human health like troubles in the respiratory system and cardiovascular system. Biomass burning particles are a complex mixture of compounds and until now, the atmospheric behavior of these particles (chemical composition and physical properties) as well as a possible influence of aging processes on human health is relatively unknown.

In order to investigate these two issues, a laboratory experiment was performed at the IfT LEAK aerosol chamber. Diluted wood smoke produced by combustion of different types of woods (spruce, beech and pellet) was introduced into the aerosol chamber; then two aging conditions were applied to compare night chemistry (ozonolysis) and day chemistry (photochemistry using UV-lamp). On-line instruments including an Aerosol Mass Spectrometer (AMS), a Multi-Angle Absorption Photometer (MAAP), a Hygroscopic Tandem Differential Mobility Analyser (H-TDMA), and a Volatility Tandem Differential Mobility Analyzer (V-TDMA) were used to measure the chemical and physical properties of the aerosols. In parallel, filter samples were performed before and after aging to compare changes in the aerosol's chemical composition and toxicity.

Here, we will focus on results provided by on-line instruments, especially the AMS. A strong increase of the nitrate signal was observed independently of experimental conditions and wood type. Due to the absence of ammonium sources, we interpreted this result as corresponding to the formation of organo-nitrate compounds rather than ammonium nitrate. However, disparities in the behavior of the organic fraction tracers like m/z 60 which is considered as a tracer for monosaccharide anhydridres (e.g. levoglucosan) and m/z 44 (CO_2^+) indicated differences in the aging processes.