Geophysical Research Abstracts
Vol. 13, EGU2011-9372, 2011
EGU General Assembly 2011

STXM-NEXAFS Investigations of Laboratory Secondary Organic Aerosols and Amazonian Background Aerosols

Christopher Pöhlker (1), Meinrat O. Andreae (1), Paulo Artaxo (2), Mary K. Gilles (3), Arthur L. D. Kilcoyne (3), Scot T. Martin (4), Ryan C. Moffet (3), Ulrich Pöschl (1), Bärbel Sinha (1), Mackenzie Smith (4), and Kenia T. Wiedemann (4)

(1) Max Planck Institute for Chemistry, Biogeochemistry, Mainz, Germany (c.pohlker@mpic.de), (2) Institute of Physics, University of São Paulo, São Paulo, Brazil, (3) Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA, (4) Harvard University, Cambridge, Massachusetts, USA

We applied Scanning Transmission X-ray Microscopy - Near Edge X-ray Absorption Fine Structure (STXM-NEXAFS) analysis to investigate the morphology and chemical composition of aerosol samples from a pristine tropical environment, the Amazon Basin. The samples were collected in the Amazonian rainforest during the rainy season and can be regarded as a natural background aerosol. The samples were found to be dominated by Secondary Organic Aerosols (SOA) in the fine and Primary Biological Aerosol Particles (PBAP) in the coarse mode. Lab-generated SOA-samples (produced by the (photo)oxidation of isoprene, α-pinene and β-caryophyllene) and microtome slices of fungal spores were measured as reference samples. The aim of this study was to investigate the microphysical and chemical properties of a tropical background aerosol and its internal mixing state.

The STXM-NEXAFS results of the lab-generated SOA have been analyzed and compared to SOA from the Amazonian region. In the Amazon samples, SOA occurred as spherical droplet-like particles or as coatings on PBAP. In the lab samples, SOA occurred as droplets of different sizes, sometimes exhibiting internal structures ('raisin-like' structure). Concerning chemical composition, the NEXAFS spectra have been utilized to estimate the elemental ratios of C, N and O. Unexpectedly, all SOA samples show a high content of reduced N (around 20% or even more). Furthermore, the spectra exhibit characteristic signal patterns for different functional groups. In most cases the spectrum near the C-edge is dominated by the carboxylate signal, but prominent peaks for hydroxyl-, carbonyl- and ether-peaks have also been observed. The spectral characteristics of the lab samples depend on the precursors applied for their generation.

For PBAP, the C-, N- and O-specific NEXAFS maps allow insights into the intracellular structure and chemical composition of fungal spores, which clearly dominate the coarse mode of the Amazonian samples. Furthermore, clusters of bioparticles could be identified. PBAP show a complex NEXAFS spectrum due to a wide variety of differently functionalized biomolecules, with different spectra and element abundances for individual cell components.