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1 Hygroscopic growth and critical supersaturations of humic-like substances in atmospheric aerosols

E. Swietlicki(1), J. Rissler (1), A. Massling (1), B. Svenningsson (2), M. Bilde (2), A. Hoffer (3), G. Frank (3) , U. Dusek (3) and G. Kiss (4)

(1) Division of Nuclear Physics, Lund University, P.O. Box 118, SE-211 00 Lund, Sweden, (2) University of Copenhagen, Department of Chemistry, Universitetsparken 5, DK-2100 Copenhagen, Denmark, (3) Max Planck Institute for Chemistry, Department of Biogeochemistry, D-55128 Mainz, Germany, (4) Air Chemistry Group of the Hungarian Academy of Sciences, University of Veszprém, 8201 Veszprém, P.O. Box 158, Hungary (Erik.Swietlicki@nuclear.lu.se / Fax: +46-46-2224709 / Phone: +46-46-2229680)

The hygroscopic and cloud-nucleating properties of humic-like substances (HULIS) extracted from atmopheric aerosols were determined in the laboratory. The two sets of aerosol samples analyzed were collected at 1) at the K-puszta rural site in Hungary about 80 km SE of Budapest, and 2) at a ground site during the LBA-SMOCC biomass burning season experiment in Rondonia, Amazonia, Brazil.

The measurements of hygroscopic growth were performed with a H-TDMA (Hygroscopic Tandem Differential Mobility Analyser), while the CCN (Cloud Condensation Nuclei) properties were determined with two different types of static thermal-gradient CCN counters.

The HULIS extracts for both the biomass smoke aerosol and the European rural background aerosol showed low hygroscopic growth. The variability in diameter growth factors (from dry to 90 % relative humidity; RH) were quite small, and fell in the range 1.04-1.07 for all HULIS extracts. All extracts also showed signs of restructuring (decreasing growth factors) as RH increased from 60-70% to 70-85%.

The cloud droplet spectra (fraction of activated particles as a function of water vapour

supersaturation) for monodisperse particles generated from the biomass smoke HULIS extracts were less dinstinct than expected if all generated particles had identical chemical composition and physical properties.

The critical supersaturations determined for HULIS extracts from the European rural background were significantly higher than for particles produced from an extract containing all water-soluble compounds.

When comparing the hygroscopic growth of the biomass smoke HULIS studied in the laboratory with in-situ H-TDMA observations of hygroscopic growth for the time periods when the samples were collected, it was evident that the HULIS can only account for a small part of the hygroscopic growth of the biomass smoke particles.