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FAST SIZE-RESOLVED AEROSOL COMPOSITION MEASUREMENTS IN MEXICO CITY WITH AN AMS. *JOSE L. JIMENEZ, Katja Dzepina, Matthew Dunn, Peter DeCarlo, Qi Zhang, and Alex Huffman, University of Colorado-Boulder; Dara Salcedo, Universidad Iberoamericana, Mexico City; Timothy Onasch, Douglas R. Worsnop, Phillip Mortimer, John T. Jayne, and Manjula R. Canagaratna, Aerodyne Research; Beatriz Cardenas, CENICA; Rainer Volkamer, Benjamin de Foy, Kirsten Johnson, Bilal Zuberi, Mario Molina, and Luisa Molina, MIT; James Smith, NCAR; Peter McMurry, University of Minnesota; and Jeffrey Gaffney and Nancy Marley, Argonne National Laboratory.*

An Aerodyne Aerosol Mass Spectrometer (AMS) was deployed to the CENICA Supersite in Mexico City during the Mexico City Metropolitan Area (MCMA-2003) field study from March 29-May 4, 2003. A nano-SMPS was also deployed at CENICA during the later part of that period. The AMS provided real-time information on mass concentrations of chemical species in/on submicron aerosols, as well as on chemically resolved size distributions, with 4-minute time resolution. The AMS mass concentration compares well with that calculated from the volume concentration of a collocated OPC (LASAIR) and the density estimated from the AMS composition. The non-refractory submicron aerosol mass (~ PM1.0) at the CENICA Supersite was comprised of about 2/3 organic carbon and 1/3 inorganic species. A recently developed procedure (Zhang et al., this conference) was applied to estimate the fraction of the organic aerosol that is combustion origin (~1/3 of organic mass) vs. oxygenated (~2/3). Two periods with very different organic mass loadings were identified: before and after the holy week and associated holiday period, and during the holiday period. The main inorganic species were ammonium sulfate and ammonium nitrate, with a smaller contribution of ammonium chloride. Intense secondary aerosol formation was observed most days, which is consistent with the high levels of aerosol precursors, radiation, and of radicals (OH, HO2) measured by other researchers at the site. Specifically, many days started with rapid nitrate and SOA formation and deposition onto the aerosol. A case study day for secondary aerosol formation (April 9th, 2003) will be presented. Particulate sulfate is mostly advected to this site, rather than locally formed. Both vertical mixing (mixing layer dynamics) and horizontal advection also play important roles in the concentrations observed at this site. The aerosol size distribution was often bimodal (in Dva), with a smaller mode centered around 100 nm (characteristic of traffic emissions) and a larger accumulation mode around 400-600 nm. Condensation of secondary species was observed on both modes, an observation confirmed by electron microscopy. The combined AMS and SMPS data reveal two main sources of ultrafine aerosol in the city: sulfate-dominated new particle formation, and traffic emissions. A beam width probe was used during the 2003 deployment to probe the shape and mixing state of the particles and to improve the absolute quantification capabilities of the AMS. Results from this probe indicate that the collection efficiency (CE) of the AMS was ~100% for all species during this campaign. We speculate that the large concentrations of ammonium nitrate and secondary organics may have resulted in nearly spherical particles during this campaign.

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AEROSOLIZATION OF MICROORGANISMS AND MICROBIAL FRAGMENTS FROM METALWORKING FLUIDS. *HONGXIA WANG, Atin Adhikari, Weixin Li, Dainius Martuzevicius, Klaus Willeke, Sergey Grinshpun, Tiina Reponen, Center for Health-related Aerosol Studies, Department of Environmental Health, University of Cincinnati, OH*

Aerosolization of microorganisms from metalworking fluids (MWFs) was studied using a laboratory-scale set-up simulating grinding operations. An optical particle counter (OPC), a condensation nucleus counter (CNC), an electrical low pressure impactor (ELPI), and a photometric aerosol mass monitor were used to measure the airborne particles and microorganisms aerosolized from MWFs. The Button Personal Inhalable Aerosol Sampler collected the microorganisms from the air for subsequent microscopic counting. The tests were performed using a semi-synthetic MWF with and without microbial contamination. Bacillus subtilis bacterial spores (aerodynamic size, da=0.9 µm) and Penicillium melinii fungal spores (da=3.1 µm) were selected to represent hydrophobic microorganisms. Pseudomonas fluorescens bacterial cells (da=0.8 µm) represented hydrophilic microorganisms. The results showed that the concentration of particles aerosolized from pure MWF increased with increasing tool rotation speed and fluid application rate. The aerosolization from MWF contaminated with each of the three tested microorganisms revealed that when the concentrations of microorganisms in the liquid are the same, the number of aerosolized B. subtilis spores was higher than that of P. fluorescens cells and P. melinii spores. We concluded that hydrophobic microorganisms are easier to aerosolize from MWF than hydrophilic microorganisms and that small size microorganisms are easier to aerosolize from MWF than large size microorganisms. Microbial contamination of MWF with P. fluorescens increased the number concentration of aerosolized particles (biological and non-biological) by a factor of 2 (as measured by the OPC). The mass concentration (as measured by the aerosol photometer) also increased by a factor 2. At the same time, there was up to 50-fold increase in the concentration of fine particles, as measured by the CNC. The data collected with the ELPI showed that the peak of the fine particle size distribution was at 0.37 µm. The results indicate that MWF mist may contain high concentrations of microbial fragments, which may not be detected by traditional microbial analysis methods, such as cultivation or microscopic counting.

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ABSTRACTS

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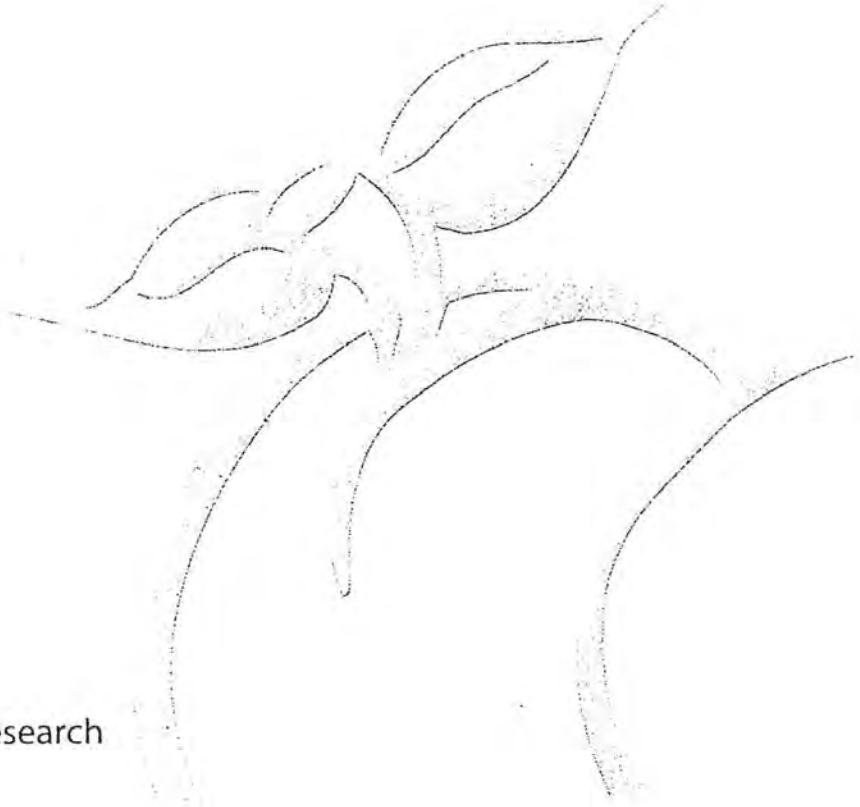

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