Atmos. Chem. Phys. Discuss., 5, S4003–S4006, 2005
www.atmos-chem-phys.org/acpd/5/S4003/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effect of physical and chemical aerosol properties on warm cloud droplet activation" *by* G. McFiggans et al.

U. Pöschl

poeschl@mpch-mainz.mpg.de

Received and published: 18 November 2005

I would like to applaud the authors for compiling a comprehensive and thorough overview and discussion of advances in the investigation and understanding of water uptake by aerosol particles and the effects on cloud droplet formation.

In addition to the referee comments and suggestions for further improvement of the manuscript, I would like to add a comment and suggestion concerning section 4.1, which addresses the effects of surface active organic compounds (surfactants).

From my perspective the discussion and references in this section are somewhat biased towards simple carboxylic acids and selected secondary organic aerosol com-

ponents, and they fail to address one of the probably most abundant classes of organic surfactants in air particulate matter: proteins, peptides, amino acids, and related amino-compounds.

Most of the recent studies which have set out to quantify this class of substances in atmospheric aerosols and precipitation have reported high concentrations, indicating that they account for a major fraction of water-soluble organic carbon in air particulate matter (see references listed below and references therein).

Moreover, Mikhailov et al. (2004) have demonstrated that proteins indeed do form envelopes around salt particles, that they can strongly influence the microstructure and porosity of mixed organic-inorganic particles, and that they do strongly influence the deliquescence, efflorescence, and hygroscopic growth of sodium chloride, ammonium nitrate, and ammonium sulfate particles even at low concentration levels. The reported results clearly show that not only organics of limited/low solubility - such as the long-chain carboxylic acids and the somewhat nebulous class of humic-like substances mostly referred to in section 4.1 - but also highly water-soluble biopolymers such as proteins and related (macro-)molecules can significantly change the surface properties and water interactions of aerosol particles (thermodynamic and kinetic effects), and that they can be efficiently included in Köhler model calculations.

Thus I would suggest to explicitly mention and reference proteins and related amino-compounds as an abundant and fairly well-defined class of organic surfactants in air particulate matter, which is likely to influence the interaction of atmospheric aerosol particles with water vapor, clouds, and precipitation.

References:

Franze, T., Weller, M.G., Niessner, R., and Pöschl, U.: Protein nitration by polluted air, Environmental Science & Technology, 39, 1673-1678, 2005.

Jaenicke, R.: Abundance of cellular material and proteins in the atmosphere, Science,

ACPD

5, S4003–S4006, 2005

308 (5718), 73-73, 2005.

Kuznetsova, M., Lee, C., and Aller, J.: Characterization of the proteinaceous matter in marine aerosols, Marine Chemistry, 96 (3-4), 359-377, 2005.

Mace, K.A., Duce, R.A., and Tindale, N.W.: Organic nitrogen in rain and aerosol at Cape Grim, Tasmania, Australia, Journal of Geophysical Research-Atmospheres, 108 (D11), 2003.

Mace, K.A., Kubilay, N., and Duce, R.A.: Organic nitrogen in rain and aerosol in the eastern Mediterranean atmosphere: An association with atmospheric dust, Journal of Geophysical Research-Atmospheres, 108 (D10), 2003.

Mace, K.A., Artaxo, P., and Duce, R.A.: Water-soluble organic nitrogen in Amazon Basin aerosols during the dry (biomass burning) and wet seasons, Journal of Geophysical Research-Atmospheres, 108 (D16), 2003.

Matsumoto, K., and Uematsu, M.: Free amino acids in marine aerosols over the western North Pacific Ocean, Atmospheric Environment, 39 (11), 2163-2170, 2005.

Miguel, A.G., Cass, G.R., Glovsky, M.M., and Weiss, J.: Allergens in paved road dust and airborne particles, Environ. Sci. Technol., 33 (23), 4159-4168, 1999.

Mikhailov, E., Vlasenko, S., Niessner, R., and Poschl, U.: Interaction of aerosol particles composed of protein and salts with water vapor: hygroscopic growth and microstructural rearrangement, Atmospheric Chemistry and Physics, 4, 323-350, 2004.

Pöschl, U.: Atmospheric aerosols: composition, transformation, climate and health effects, Angewandte Chemie International Edition, DOI:10.1002/ange.200501122, 2005.

Saxena, P., and Hildemann, L.M.: Water-soluble organics in atmospheric particles: A critical review of the literature and application of thermodynamics to identify candidate compounds, Journal of Atmospheric Chemistry. May, 24 (1), 57-109, 1996.

Zhang, Q., and Anastasio, C.: Chemistry of fog waters in California's Central Valley -

Part 3: concentrations and speciation of organic and inorganic nitrogen, Atmospheric Environment, 35 (32), 5629-5643, 2001.

Zhang, Q., Anastasio, C., and Jimemez-Cruz, M.: Water-soluble organic nitrogen in atmospheric fine particles (PM2.5) from northern California, Journal of Geophysical Research-Atmospheres, 107 (D11), 2002.

Zhang, Q., and Anastasio, C.: Free and combined amino compounds in atmospheric fine particles (PM2.5) and fog waters from Northern California, Atmospheric Environment, 37 (16), 2247-2258, 2003.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 8507, 2005.