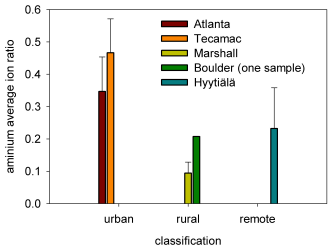
New Insight on the Atmosphere's Tiniest Particles

Research Highlight

Many of the atmosphere's tiniest particles emerge through a different process than previously thought, according to analysis from the research team headed by Jim Smith (National Center for Atmospheric Research) and Peter McMurry (University of Minnesota) made possible with funding from the DOE's Atmospheric System Research program. The group has found that aminium salts make up as much as half of the mass of newly formed particles in places as diverse as Atlanta, Mexico City, northeast Colorado, and Finland.

Studying nanoparticles in the field is difficult due to their tiny size and rapid formation. Smith and McMurry employed a unique instrument, the Thermal Desorption Chemical Ionization Mass Spectrometer (TDCIMS), to detect the molecular composition of ambient aerosol as small as 8 nm in diameter. In the urban areas studied, the team found that aminium salts, mixtures of amines with inorganic as well as organic acids, comprised almost half of the identified ions within nanoparticles. Sulfates were far less prevalent. This leaves a large part of the nanoparticle growth still unexplained. They and colleagues hope to better analyze the sources of amines. Large livestock operations are an important source, but more observations are needed.

Although present in the atmosphere in relatively low concentrations, this work shows how even a small amount of a substance such as amines in the air can have a big effect on nanoparticle formation. These newly discovered oraganic salt compounds give hope that models can be developed that can predict the impacts of new particle formation on human health and climate.



Overview of the molar ratio of aminium ions (ratio of total detected cations) during nanoparticle growth events, grouped according the land type. Error bars indicate standard deviation of the mean.

Reference(s)

Smith JN, KC Barsanti, HR Friedli, M Ehn, M Kulmala, DR Collins, JH Scheckman, BJ Williams, and PH McMurry. 2011. "Observations of aminium salts in atmospheric nanoparticles and possible climatic implications." Proceedings of the National Academy of Sciences, 107(15), doi:10.1073/pnas.0912127107.

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Aerosol Life Cycle