

Research Highlight

DOE scientists at Pacific Northwest and Lawrence Berkeley National Laboratories found that sea salt, launched into the atmosphere by ocean waves, reacts with organic acids produced by human-caused pollution to yield particles loaded with organic salts and depleted in chloride. These reactions occur during hydration-dehydration cycles of mixed sea salt/organic particles in the atmosphere, and induce changes in particle composition and morphology, which in turn will modify their acidity, hygroscopic, and optical properties.

Conducting a chemical imaging analysis on particles sampled by aircraft during the Carbonaceous Aerosol and Radiative Effects Study (CARES) in 2010, they found that sea salt particles react with water soluble organic acids in the atmosphere through a unique mechanism which has been overlooked in atmospheric chemistry. The reactions release semi-volatile hydrochloric acid into the atmosphere and leave behind sea salt particles drained of chloride. The researchers used laboratory studies to confirm their field observations, mixing sodium chloride (NaCl) with organic acids to produce the chloride-depleted particles. The chemical imaging was conducted using electron microscopy at the Environmental Molecular Sciences Laboratory, and X-ray spectro-microscopy at the Advanced Light Source – two national scientific user facilities sponsored by the DOE's Office of Biological and Environmental Research and located at PNNL and LBNL, respectively.

The researchers suggest that these unique reactions be included in atmospheric chemistry models.

Reference(s)

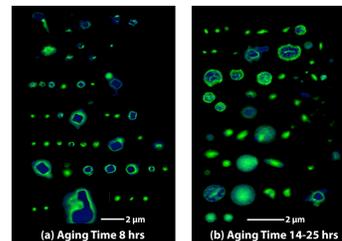
Laskin A, RC Moffet, MK Gilles, JD Fast, R Zaveri, B Wang, P Nigge, and J Shutthanandan. 2012. "Tropospheric chemistry of internally mixed sea salt and organic particles: Surprising reactivity of NaCl with weak organic acids." *Journal of Geophysical Research*, 117, D15302, doi:10.1029/2012JD017743.

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Working Group(s)

Aerosol Life Cycle



X-ray chemical imaging maps of individual particles collected in CARES 2010 study. Areas dominated by sea salt and organic acid constituents are colored by blue and green, respectively.