Scientists find missing piece of air particle equation hiding in the walls

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Credit: NASA

Laboratory chamber walls have been stealing vapors, causing researchers to underestimate the formation of secondary organic aerosol in the atmosphere.

A study published April 7 in *PNAS* Online Early Edition describes how a team of scientists, including researchers from the University of California, Davis, showed that vapor losses to the walls of laboratory chambers can suppress the formation of secondary organic aerosol, which in turn has contributed to the underprediction of SOA in climate

and air quality models.

SOA impacts air quality and climate and makes up a major fraction of particulate matter in the atmosphere. Yet SOA concentrations have been significantly underestimated in regional air quality models.

Nearly all models of secondary organic aerosols are tied to observations of their formation in laboratory chamber experiments. However, the effect of vapor loss to chamber walls previously had been neglected.

"To accurately predict the health and climate impacts of particles, we need to accurately predict their abundance in the atmosphere," said co-author Christopher Cappa, professor of civil and environmental engineering at UC Davis.

Secondary organic aerosols are formed primarily through chemistry that occurs in the gas phase.

"If, along the path from moving from the gas phase to the particle phase, another surface steals that gas-phase material, you wouldn't form as much of the particle as you would think," Cappa said. "That's what we've demonstrated is happening: The walls of these chambers act as a sponge for the vapors and compete with the particles for these vapors."

Researchers from UC Davis and the California Institute of Technology conducted a series of experiments in a 24 cubic meter environmental chamber using the volatile organic compound toluene, which is emitted from motor vehicles and is an important SOA precursor.

Cappa said the researchers' next steps are to assess the vapor effect more broadly for other compounds to more fully understand these wall effects and make better predictions for the future.

More information: Influence of vapor wall loss in laboratory chambers on yields of secondary organic aerosol, www.pnas.org/cgi/doi/10.1073/pnas.1404727111

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