



## Photochemical ageing of plumes from emission sources based on chamber simulation

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Study on atmospheric ageing of plumes from emission sources is essential to understand their contribution to both secondary and primary pollutants occurring in the ambient air. Here we directly introduced vehicle exhaust, biomass burning plume, industrial solvents and cooking plumes into a smog chamber with 30 m<sup>3</sup> fluorinated ethylene propylene (FEP) Teflon film reactor housed in a temperature-controlled enclosure, for characterizing primarily emitted air pollutants and for investigating secondarily formed products during photo-oxidation. Moreover, we also initiated study on the formation of secondary aerosols when gasoline vehicle exhaust is mixed with typical coal combustion pollutant SO<sub>2</sub> or typical agricultural-related pollutant NH<sub>3</sub>. Formation of secondary organic aerosols (SOA) from typical solvent toluene was also investigated in ambient air matrix in comparison with purified air matrix. Main findings include: 1) Except for exhaust from idling gasoline vehicles, traditional precursor volatile organic compounds could only explain a very small fraction of SOA formed from vehicle exhaust, biomass burning or cooking plumes, suggesting knowledge gap in SOA precursors; 2) There is the need to re-think vehicle emission standards with a combined primary and/or secondary contribution of vehicle exhaust to PM<sub>2.5</sub> or other secondary pollutants such as ozone; 3) When mixed with SO<sub>2</sub>, the gasoline vehicle exhaust revealed an increase of SOA production factor by 60-200% and meanwhile SO<sub>2</sub> oxidation rates increased about a factor of 2.7; when the aged gasoline vehicle exhaust were mixing with NH<sub>3</sub>, both particle number and mass concentrations were increasing explosively. These phenomenons implied the complex interaction during ageing of co-existing source emissions. 4) For typical combination of "toluene+SO<sub>2</sub>+NO<sub>x</sub>", when compared to chamber simulation with purified air as matrix, both SOA formation and SO<sub>2</sub> oxidation were greatly enhanced under ambient air matrix, and the enhancement of SO<sub>2</sub> oxidation was found be largely heterogenous and the enhancement of SOA formation seemed to be acid-catalyzed.