

Particulate Matter Production from and Indoor Air Quality Implications of Household Volatile Organic Compounds

Environmental and Analytical Chemistry

Activities for participating students:

Generate and detect airborne nanoparticulate matter, solvent extraction, and gas chromatography/mass spectroscopy.

Project Description:

Particulate matter (PM) pollution is detrimental to public health and indoor air quality. The toxicology of PM is not known, and the myriad of sources and chemical components of PM require investigation. One source of PM in indoor environments is the reaction of ozone with household volatile organic compounds (VOCs), where some the products have reduced volatility and partition into PM. Recent work has shown that some household air fresheners and cleaners contain VOCs such as monoterpenes, which react with ozone and produce PM at levels that degrade air quality. The reaction products from this PM source are not known. To address this issue, PM is generated in 5.5 m³ Teflon reaction chamber by exposing individual household products to ozone. The mass concentration of PM generated by the ozonation reaction is measured by scanning mobility particle size (SMPS) spectrometry. PM samples are collected onto quartz filters. Solvent extraction removes PM from the filters, the extracts are concentrated, and the analytes are converted to their trimethyl silyl ester and ether products. The extracts are analyzed by a Varian gas chromatograph with ion trap mass spectrometric detection using electron impact and chemical ionization. The analysis of the ion fragments produced in the ion trap enable the identification and quantification of the chemical species found in PM. The product characterizations are used in conjunction with measures of the concentration of PM to determine which household VOCs are prone to PM formation and predict their toxicity.

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