A Novel Mobile Air Quality Measurement for Emerging Indoor Emission Sources

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Abstract

Indoor air pollution has been asserted as an emerging source, yet its contribution to air quality is poorly understood. While regional and scattered measurements have identified tracers associated with indoor sources like cooking emissions, these approaches fall short in identifying localised sources and assessing their significance over time and the combined impact of multiple sources. This study presents a novel air quality observation method designed to characterise localised and persistent pollutants. Utilising a mobile laboratory equipped with a selective ion flow tube mass spectrometry (SIFT-MS), we conducted comprehensive measurements of volatile organic compounds (VOCs) from cooking and traffic emissions, volatile chemical products (VCPs), and personal care products (PCPs) in Bradford and York, United Kingdom. Using the fast response data encompassing over 30 species from a minimum of 20 mobile measurements in each city across summer and winter, we developed metrics to identify indoor sources in the atmosphere. Using this approach, we found that acetone, a PCPs tracer, exhibited high concentrations in areas densely populated by beauty salons. Moreover, the concentration profile of acetaldehyde, originating from vehicle and cooking emissions, was associated with the density of restaurants. The contribution of indoor sources to urban air quality was further confirmed by elevated nonanal concentrations, a unique cooking tracer, in densely populated restaurant areas. Notably, our approach could isolate traffic emissions contribution from indoor emissions, even when they share similar emission profiles. Our method offers a new perspective on air quality monitoring, characterised by flexibility and robustness. This approach will be invaluable in evaluating pollutants across diverse contexts, from urban to rural areas. Furthermore, it can characterise air pollutants with multiple sources. Notably, this method provides policymakers with insights to develop effective mitigation strategies and assess the efficacy of implemented measures.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

MAP-AQ: Monitoring, Analysis and Prediction of Air Quality, BBURNED: Biomass Burning Uncertainty: ReactioNs, Emissions and Dynamics