Proton Transfer Reaction-Mass Spectrometry measurements of propylene glycol and diethylene glycol: preliminary results

Keri D. Nauman
University of Montana, Missoula, kn107626@umconnect.umt.edu

Follow this and additional works at: https://scholarworks.umt.edu/umcur
Let us know how access to this document benefits you.

https://scholarworks.umt.edu/umcur/2020/physicalsciences_poster/7

This Poster is brought to you for free and open access by ScholarWorks at University of Montana. It has been accepted for inclusion in University of Montana Conference on Undergraduate Research (UMCUR) by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.
Atmospheric volatile organic compounds (VOCs) are precursors of fine particulate matter and ground-level ozone, both of which threaten the public health and are regulated by the U.S. EPA. Due to the decrease in emissions from traditional transportation vehicles and power plants in the last four decades, volatile chemical products (VCPs) have become an emerging contributor to VOC emissions in urban atmosphere[1]. These VCPs are typically found in household products as inactive ingredients, including cleaning agents, aerosol sprays, personal/hygienic care products, printer ink, pesticides, etc. Once these products are used, the VCPs volatilize and participate in reactions that form ground-level ozone and fine particulate matter. Despite their prevalence in our daily lives, these VCPs and their contribution to VOC emissions, both indoors and outdoors, remain understudied and uncharacterized. PTR-ToF-MS provides real-time VOC concentration measurements in ambient air. The PTR instrument has been utilized in a research aircraft to study wildfire plumes, deployed in the Arctic for measuring urban organic pollutants, and installed at the top of Mt. Bachelor to collect data on ambient air pollution in the western U.S.

VOC emissions are a public health issue due to fine particulate matter being able to penetrate lung tissue and can cause severe damage or even death. Indoor household air pollution from solid fuels is one of the leading risk factors associated with various diseases, especially cardiovascular and circulatory disease. Every year, indoor air pollution can contribute up to 2.6-4.4 million deaths globally. Outdoor air pollution, specifically ambient particulate matter pollution is the ninth leading risk factor globally and is estimated to account for 2.7-3.5 million deaths. Combined, indoor and outdoor air pollution causes approximately 5-8 million deaths per year.

Methods

Instruments
- Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS)
- Li COR CO2 analyzer

Permeation-Based Calibration System
- Li COR CO2 analyzer measures the VOC concentration from the permeation source by oxidizing it to CO2 in a catalytic converter.
- Relationship between the VOC concentration and CO2 concentration is determined via combustion reaction.
- VOCs are isolated in the drift tube of the PTR-ToF-MS, where the proton transfer reaction from H3O+ ions to the VOC can take place.
- Species with proton affinities higher than water are then detected by the quadrupole mass spectrometer.
- PTR-ToF-MS measures the protonation from the primary VOC in counts per second.
- Standard addition dilutions were performed to obtain calibrations.

Indoor Air Pollutant Measurements During Surface Refinishing
- Laboratory floors were refinishing on January 7th
- Ambient air was sampled from January 7th to January 14th, 2020 every 4 hours
- Bravo Power-Foam cleaner was used to treat any rust or spot buildups
- Vectra floor finish was applied
- Both products contain diethylene glycol solvents
- We examine the air pollutant exposure to the cleaning crew and office occupants

References & Acknowledgements

Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number P20GM103474. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.