4.044 Insight into nitro-phenolics in organic aerosol during high pollution events in Beijing.

Early Career Scientist

Presenting Author:
William James DIXON, Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK, wjd506@york.ac.uk

Co-Authors:
Kelly L. Pereira, Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK
Freya A. Squires, Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK
Rachel E. Dunmore, Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK
Daniel J. Bryant, Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK
Andrew R. Rickard, Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK
Yele Sun, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, People's Republic of China
Weiqi Xu, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, People's Republic of China
Jacqueline F. Hamilton , Wolfson Atmospheric Chemistry Laboratories, Department of Chemistry, University of York, York, UK

Abstract:

Air pollution, particularly from particulate matter of diameter, 2.5 microns or less ($PM_{2.5}$) has been linked to cardio-respiratory disease and cancer. The inhabitants of mega cities such as Beijing (with a population of over 20 million) are at high risk from exposure to PM $_{2.5}$, with official estimates of $PM_{2.5}$ in Beijing at 86 µg m^{-3} for 2014. Nitro-phenolic compounds are known phytotoxins and are linked with cancer in humans, they also contribute to brown carbon and have impacts on climate.
In this study, we examine the composition of organic aerosol collected during winter and summer in Beijing during the Air Pollution and Human Health (APHH) project. An extensive mass spectra database was built from literature and secondary organic aerosol tracers from chamber experiments. High resolution (up to ½ hourly) filter samples were analysed using high-throughput ultra-high performance liquid chromatography and tandem mass spectrometry (UHPLC-MS^2) analysis to determine the concentrations of nitro-phenolics. Modern data mining techniques were combined with meteorological measurements to determine the sources of nitro-phenolics in Beijing.
Thirteen commonly observed nitro-phenolic compounds were quantified across the campaigns and their time series used to determine preliminary source apportionment.

The nitro-phenolic compounds contributed on average 6.4% and 3.2% (for winter and summer respectively) of the total organic carbon (TOC) and displayed pronounced diurnal cycles during the two campaigns, peaking around 09:00, with minima overnight. An additional peak is observed in the summer diurnal cycle around 14:00, corresponding to photo-oxidation of aromatics. Of the thirteen compounds, dominant species observed include 2-Nitro-1-Naphthol and 4-Nitrophenol. The effect of structural isomerism of nitro-phenolics on the relative ionisation efficiency was investigated, with compounds with the nitro group in the ortho- position had 1-2 orders of magnitude lower ionisation efficiency. Outside of these compounds, the sources of all observed nitrogen containing compounds were investigated.